FOR·THE·INCREASE·AND·DIFFVSION·OF·KNOWLEDGE·AMONG·MEN·

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SMITHSONIAN·INSTITVTION·WASHINGTON·1846·

ANNUAL REPORT

OF THE

BOARD OF REGENTS

OF THE

SMITHSONIAN INSTITUTION,

SHOWING

THE OPERATIONS, EXPENDITURES, AND CONDITION
OF THE INSTITUTION

FOR THE

YEAR ENDING JUNE 30, 1897.

REPORT

OF THE

U. S. NATIONAL MUSEUM.

PART 1.

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"Of the Report of the Smithsonian Institution, ten thousand copies; one thousand copies for the Senate, two thousand for the House, five thousand for distribution by the Smithsonian Institution, and two thousand for distribution by the National Museum."

REPORT

OF THE

U. S. NATIONAL MUSEUM,

UNDER THE DIRECTION OF

THE SMITHSONIAN INSTITUTION,

FOR THE

YEAR ENDING JUNE 30, 1897.

REPORT OF THE U. S. NATIONAL MUSEUM FOR THE YEAR ENDING JUNE 30, 1897.

SUBJECTS.

I. Report of the Acting Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, with Appendices.

II. Papers describing and illustrating collections in the U, S. National Museum.

CONTENTS.

PART I.

REPORT OF THE ASSISTANT SECRETARY IN CHARGE OF THE NATIONAL MUSEUM.

I.—GENERAL CONSIDERATIONS.

II.—SPECIAL TOPICS OF THE YEAR.

III.—REVIEW OF WORK IN THE SCIENTIFIC DEPARTMENTS.

LIST OF ILLUSTRATIONS.

PLATES.

RECENT FORAMINIFERA. By JAMES M. FLINT.

PIPES AND SMOKING CUSTOMS OF THE AMERICAN ABORIGINES, BASED ON MATERIAL IN THE U. S. NATIONAL MUSEUM.

By JOSEPH D. MCGUIRE.

ARROWPOINTS, SPEARHEADS, AND KNIVES OF PREHISTORIC TIMES.

By THOMAS WILSON.

TEXT FIGURES.

Pipes and Smoking Customs of the American Aborigines, Based on Material in the U. S. National Museum.

By Joseph D. McGuire.

THE MAN'S KNIFE AMONG THE NORTH AMERICAN INDIANS.

By OTIS TUFTON MASON.

ARROWPOINTS, SPEARHEADS, AND KNIVES OF PREHISTORIC TIMES.

By THOMAS WILSON.

PART I.

REPORT

UPON THE

CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1897.

BY

CHARLES D. WALCOTT,

ACTING ASSISTANT SECRETARY OF THE SMITHSONIAN INSTITUTION,
IN CHARGE OF THE U. S. NATIONAL MUSEUM.

REPORT

UPON

THE CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1897.

BY

CHARLES D. WALCOTT,

Acting Assistant Secretary, Smithsonian Institution, in charge of U. S. National Museum.

I.—GENERAL CONSIDERATIONS.

It was my good fortune to be associated with the late Dr. G. Brown Goode for many years, both as a friend and as an Honorary Curator of the National Museum, with a laboratory in the Museum building. We were thus in continuous social and professional intercourse for a period of fourteen years, and during this time I became well acquainted with the great work that he was doing, and obtained a fairly clear conception of the history, present condition, and, to a certain extent, future needs of the Museum. Nevertheless, when, after Professor Goode's death, the Secretary of the Smithsonian Institution, Dr. S. P. Langley, requested me to take temporary charge of the Museum, it was only after much hesitancy that I concluded to assume the responsibility, my reluctance arising chiefly from the fear that, owing to official duties previously assumed, the comparatively small amount of time that I could devote to the Museum would not suffice for the proper care and advancement of its interests. However, I took charge of the Museum in January, 1897, and my hope that the cooperation and support of the officers and assistants connected with the Museum would be so large and so efficient as satisfactorily to supplement my own labors, has been realized.

In a conversation had with Dr. Goode a few weeks before his death I learned that he wished to make more or less of a reorganization of the Museum staff and collections, and had he lived there is no doubt that this would have been done at an early day, on lines that he had already outlined in various papers. Soon after taking charge I made a thorough investigation of the personnel and organization of the Museum, and made a number of recommendations to the Secretary, which were approved and went into effect July 1, 1897. The classification in force prior to that date, printed in the body of this report, had

been in use many years. The new organization, which went into effect July 1, 1897, will be found on pages 6 and 7.

It has been the custom to present in the Annual Report of the Museum certain general considerations. In following this precedent reference will be made to the functions and policy of the Museum as outlined by Dr. Goode.

GENERAL CONSIDERATIONS.

By act of Congress passed in 1846 the Smithsonian Institution became the only lawful place of deposit for "all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens belonging to the United States." These collections have served as a nucleus for the National Museum of the United States. For many years this Museum was supported entirely at the expense of the Smithson fund, and a considerable portion of the collections is the property of the Institution through gift or purchase.

The early history of the Museum—in the building up of which Professor Henry, and later Professor Baird, assisted so ably by Dr. Goode, took such great interest—is already well known to the readers of the National Museum reports, the first chapters of which in recent years having been devoted to its presentation and discussion. A special paper treating of the relations between the Smithsonian Institution and the National Museum and the early collections which came into its possession was prepared by the late Dr. G. Brown Goode, under the title "The Genesis of the National Museum," in 1891.[1]

In an historical review Dr. Goode pointed out that the history of the Museum may be divided into three periods—first, from the foundation of the Smithsonian Institution to 1857, during which time specimens were collected solely to serve as materials for research; second, from 1857, when the Institution assumed the custody of the "National Cabinet of Curiosities," to 1876, during which interval the Museum became a place of deposit for scientific collections which had already been studied; and, third, from 1876 to the present time, in which the Museum has undertaken more fully the additional task of gathering collections and exhibiting them on account of their value from an educational standpoint.

When the present Museum building was first occupied, in 1881, elaborate plans were made for the reorganization of the Museum staff. The first of them (Circular 1) is entitled "Plan of organization and regulations." Of this it may be said, in passing, that the regulations embodied therein were so admirably considered and drawn up that no radical changes have become necessary since it was issued, although occasional minor modifications and additions have been made from time to time, to meet the special requirements of varying conditions,

[1] Report of the Smithsonian Institution. U. S. National Museum, pp. 273–330.

and on account of the establishment of new departments and sections in the Museum. In this pamphlet the functions and policy of the Museum are clearly defined, as may be seen from the following paragraphs quoted from its pages:

The collections in the National Museum are intended to exhibit the natural and industrial resources primarily of the United States and secondarily of those of the remainder of the world, for the purpose of comparison.

The activity of the Museum is exerted in three directions: (*a*) The permanent preservation of objects already in its possession; (*b*) the acquisition of new material; (*c*) the utilization of material already in its possession, by its exhibition in the most instructive manner and by the prosecution of and publication of scientific researches for which it forms the basis; by the distribution of properly labeled duplicates of materials to colleges and other educational institutions.

The preservation of material is accomplished by means of the vigilance of the curators and the skill of the preparators.

New material is acquired (*a*), in accordance with law, from the various government surveys and expeditions; (*b*) by gift from individuals, from other institutions, and from foreign governments; (*c*) by exchange for its duplicate specimens or publications; (*d*) by the efforts of officers of the Museum, who make collections in connection with their regular duties or are detailed for special service of this nature; (*e*) by purchase, when appropriations are made by Congress for that purpose.

The treasures in the custody of the Museum are utilized to the world by exhibiting them to the public, and by encouraging investigations on the part of the officers of the Museum and other suitable persons, and facilitating the publication of the results; also by the distribution to other museums and educational institutions of duplicate specimens, which have formed the basis of scientific investigation, these being identified and labeled by the best authorities.

By these means the Museum fulfills a threefold function:

1. It is a museum of record, in which are preserved the material foundations of an enormous amount of scientific knowledge, the types of numerous past investigations. This is especially the case with those materials which have served as a foundation for the reports upon the resources of the United States. Types of investigations made outside of the Museum are also incorporated.

2. It is a museum of research, by reason of the policy which aims to make its contents serve as fully as possible as a stimulus to and a foundation for the studies of scientific investigators.

Research is necessary in order to identify and group the objects in the most philosophical and instructive relations. Its officers are selected for their ability as investigators, as well as for their trustworthiness and abilities as custodians, and its treasures are open to the use of any honest student.

3. It is an educational museum of the broadest type, by reason of its policy of illustrating by specimens of every kind of natural object and every manifestation of human thought and activity, by displaying descriptive labels adapted to the popular mind, and by its policy of distributing its publications and its named series of duplicates.

The collections forming the National Museum were from the beginning very diverse in character, and when the new building for the Museum was ready for occupancy in 1881 it was extremely desirable that a very comprehensive classification should be adopted. Such a classification was elaborated by Dr. Goode (Circular 13), in which man was the central figure. Natural objects, both animate and inanimate,

were regarded as his resources, and each of the arts resulting from the utilization of these resources was assigned its proper place.

While this great anthropocentric scheme of classification, with its multiplicity of divisions, was of the highest utility in arranging and distributing the vast assemblage of objects in the Museum, it was recognized at the same time (Circular 1) that the collections could readily be administered by the establishment of four principal scientific departments—those of anthropology, zoology, botany, and geology.

Various causes prevented the adoption of these departments; minor divisions and sections along these lines had multiplied from year to year to meet current demands until it became apparent that further development had practically reached a limit and that a consolidation under a few principal departments was imperative.

The new plan of organization, which included three departments—Anthropology, Biology (or Zoology and Botany combined), and Geology (including Paleontology), was formulated and went into effect July 1, 1897. It is given in detail in the following tabulation. The results of its operation will be considered in the report for 1898.

THE SCIENTIFIC AND ADMINISTRATIVE STAFF.[1]

S. P. Langley, Secretary of the Smithsonian Institution, Keeper, Ex-Officio.
Charles D. Walcott, Acting Assistant Secretary of the Smithsonian Institution, in charge of the U. S. National Museum.
Frederick W. True, Executive Curator.

SCIENTIFIC STAFF.

DEPARTMENT OF ANTHROPOLOGY:
W. H. Holmes, Head Curator.
(a) *Division of Ethnology:*
O. T. Mason, Curator.
Walter Hough, Assistant Curator.
F. H. Cushing, Collaborator.
J. W. Fewkes, Collaborator.
(b) *Division of Historic Archæology:*
Paul Haupt, Honorary Curator.
Cyrus Adler Honorary Assistant Curator.
I. M. Casanowicz, Aid.
(c) *Division of Prehistoric Archæology:*
Thomas Wilson, Curator.
(d) *Division of Technology (Mechanical phases):*
J. E. Watkins, Curator.
Section of Electricity:
G. C. Maynard, Custodian.
(e) *Division of Graphic Arts:*
S. R. Koehler, Honorary Curator.
Section of Photography:
T. W. Smillie, Custodian.
(f) *Division of Medicine:*
J. M. Flint, U. S. N., Honorary Curator.
(g) *Division of Religions:*
Section of Historic Religious Ceremonials:
Cyrus Adler, Custodian.
(h) *Division of History and Biography:*
Section of American History:
A. H. Clark, Custodian.
Paul Beckwith, Aid.

DEPARTMENT OF BIOLOGY:
Frederick W. True, Head Curator.
(a) *Division of Mammals:*
Frederick W. True, Acting Curator.
G. S. Miller, jr., Assistant Curator.
D. W. Prentiss, Aid.
(b) *Division of Birds:*
Robert Ridgway, Curator.
Charles W. Richmond, Assistant Curator.
J. H. Riley, Aid.
Section of Birds' Eggs:
William L. Ralph, Custodian.
(c) *Division of Reptiles and Batrachians:*
Leonhard Stejneger, Curator.
(d) *Division of Fishes:*
Tarleton H. Bean, Honorary Curator.
Barton A. Bean, Assistant Curator.
(e) *Division of Mollusks:*
William H. Dall, Honorary Curator.
C. T. Simpson, Aid.
Paul Bartsch, Aid.
(f) *Division of Insects:*
L. O. Howard, Honorary Curator.
W. H. Ashmead, Assistant Curator.
R. P. Currie, Aid.
Section of Hymenoptera:
W. H. Ashmead, In charge.
Section of Myriapoda:
O. F. Cook, Custodian.

[1] The organization of the staff for the year ending June 30, 1897, is printed in Appendix I.

SCIENTIFIC STAFF—Continued.

DEPARTMENT OF BIOLOGY—Continued.

Section of Diptera:
D. W. Coquillett, Custodian.

Section of Coleoptera:
W. A. Schwarz, Custodian.

Section of Lepidoptera:
Harrison G. Dyar, Custodian.

(*g*) *Division of Marine Invertebrates:*
Richard Rathbun, Honorary Curator.
J. E. Benedict, First Assistant Curator.
M. J. Rathbun, Second Assistant Curator.

Section of Helminthological Collections:
C. W. Stiles, Custodian.

(*h*) *Division of Comparative Anatomy:*
Frederic A. Lucas, Curator.

(*i*) *Division of Plants (National Herbarium):*
Frederick V. Coville, Honorary Curator.
J. N. Rose, Assistant Curator.
C. L. Pollard, Assistant Curator.
O. F. Cook, Assistant Curator.
Miss Carrie Harrison, Aid.

Section of Forestry:
B. E. Fernow, Honorary Curator.

Section of Algæ:
W. T. Swingle, Custodian.

Section of Lower Fungi:
D. G. Fairchild, Custodian.

Associates in Zoology (Honorary):
Theodore N. Gill.
C. Hart Merriam.
R. E. C. Stearns.

DEPARTMENT OF GEOLOGY:
George P. Merrill, Head Curator.

(*a*) *Division of Physical and Chemical Geology (Systematic and Applied):*
George P. Merrill, Curator.
——— ———, Assistant Curator.
W. H. Newhall, Aid.

(*b*) *Division of Mineralogy:*
F. W. Clarke, Honorary Curator.
Wirt Tassin, Assistant Curator.
Rev. Dr. L. T. Chamberlain, Custodian of Gems and Precious Stones.

(*c*) *Division of Stratigraphic Palæontology:*
Charles D. Walcott, Honorary Curator.
Charles Schuchert, Assistant Curator.

Section of Vertebrate Fossils:
O. C. Marsh, Honorary Curator.
F. A. Lucas, Acting Assistant Curator.

Section of Invertebrate Fossils:
Paleozoic: Charles Schuchert, Custodian.
Mesozoic: T. W. Stanton, Custodian.
Cenozoic: W. H. Dall, Associate Curator.

Section of Paleo-botany:
Lester F. Ward, Associate Curator.
F. H. Knowlton, Custodian of Mesozoic Plants.
David White, Custodian of Paleozoic Plants.

Associate in Paleontology (Honorary):
Charles A. White.

ADMINISTRATIVE STAFF.

Chief Clerk, W. V. Cox.
Chief of Buildings and Superintendence, J. E. Watkins.
Chief of Correspondence and Documents, R. I. Geare.
Photographer, T. W. Smillie.
Registrar, S. C. Brown.
Disbursing Clerk, W. W. Karr.
Property Clerk, W. A. Knowles (Acting).
Librarian, Cyrus Adler.
Assistant Librarian, N. P. Scudder.
Editor, Marcus Benjamin.

Work of the Museum.—Thus far, reference has been made to the origin and growth of the collections, and to the plans adopted for their proper installation and exhibition. There are, however, other functions of the Museum which have been brought into operation from time to time with a special view to aiding the scientific work of students and investigators. Thus, during the year covered by this report, nearly 27,000 geological and biological specimens, selected from the duplicates, were distributed to universities, colleges, and in a less degree to normal schools also. The publications of the Museum, consisting of the Annual Report, Proceedings and Bulletins, are distributed as freely as the limited editions will permit, to libraries and individuals, both at home and abroad. The constantly increasing requests for the identification of specimens are invariably complied with, except when analyses of geological specimens are desired. These the Museum can not make.

as it has no facilities for doing such work, nor is it considered expedient that the curators should expend their time in assaying material sent for the purpose of furthering purely commercial interests. The thousands of letters containing requests for information on almost every conceivable topic are all carefully answered. These now number from 12,000 to 15,000 a year. Not only is much of the time of the curators consumed in furnishing data for replies, but where the request shows a *bona fide* desire for scientific information, publications bearing upon the subject are carefully selected and forwarded, free of charge, to the applicant.

Additional remarks on the work of the Museum in public education may be found on pages 18–20 of the Report of the National Museum for 1895.

The library of the Museum, which was established primarily as an aid to the curators in their Museum work, is now under excellent control and is increasing rapidly. Sectional libraries have been established in every department and section, whereby each curator has close at hand such books as he may desire to consult in his special field of work. The privileges of consulting the books in the main collection are freely extended to a limited number of persons who, although not officially connected with the Museum, have given satisfactory evidence of their desire to avail themselves of the benefits to be derived from access to the library.

Popular courses of lectures have been frequently provided, and, in addition, the lecture hall has been placed at the disposal of societies desiring to hold their meetings in the Museum, or to give lectures on special educational topics.

To sum up the policy and aims of the Museum, it may be said that the leading ideas kept in mind are to aid in the education and elevation of the masses, and to promote the advancement of scientific research, (1) through the medium of the collections exhibited; (2) by affording to specialists access to the "reserve" collections; (3) by the identification of specimens; (4) through the agency of the library; (5) by the donation of specimens to educational institutions; (6) by the distribution of its publications; (7) by its lecture courses, and (8) by imparting special information through correspondence.

II.—SPECIAL TOPICS OF THE YEAR.

THE MUSEUM STAFF.

Dr. G. Brown Goode, Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, died on September 6, 1896. An extended account of the life and services of this eminent naturalist and museum administrator will be found in another volume of this report. The affairs of the Museum were administered by Dr. Frederick W. True, Executive Curator, until January 27, 1897, when the present Acting Assistant Secretary was appointed to take charge.

Mr. W. C. Winlock, honorary curator of physical apparatus, died on September 20, at Bay Head, New Jersey.

The superintendent of buildings, Mr. Henry Horan, died on September 29. A new division, that of Buildings and Superintendence, was organized on October 19, to take the place of the former department of Buildings and Labor, and Mr. J. E. Watkins, curator of the technological collections, was placed in charge.

Maj. Charles Bendire, U. S. A., honorary curator of birds' eggs, died on February 4, at Jacksonville, Florida.

Dr. F. W. True was appointed Representative of the Smithsonian Institution and National Museum for the Tennessee Centennial Exposition, which opened at Nashville, Tenn., May 1, 1897. Mr. W. V. Cox was assigned to special duty in connection with the same Exposition on January 27. On February 2 Mr. J. L. Willige was designated acting chief clerk.

On June 6 Dr. Leonhard Stejneger and Mr. F. A. Lucas were detailed temporarily, by order of the President of the United States, for duty on the Alaska Fur-Seal Investigation Commission.

Mr. J. N. Rose and Mr. C. L. Pollard, assistant curators in the department of botany, were transferred from the Department of Agriculture to the Museum roll. Prof. O. F. Cook was appointed assistant curator, and Miss Carrie Harrison, aid, in the same department.

Mr. T. W. Smillie was designated custodian of the photographic collections on July 15.

Rev. Dr. L. T. Chamberlain, of New York City, was placed in charge of the collection of gems and precious stones on January 11.

Mr. M. L. Linell, aid in the department of insects, died on May 3.

Dr. I. M. Casanowicz was appointed aid on August 12, 1896.

A list of the officers of the Museum, corrected to June 30, 1897, is printed in Appendix I.

ACCESSIONS TO THE COLLECTIONS.

There has been an increase of more than 50 per cent in the number of specimens received during the year, as compared with 1896, the total having been 111,910. The number of accessions or lots of material shows an increase of 168, giving a total of 1,467 accessions for the year just closed. The increase is most apparent in the departments of botany, insects, mollusks, geology, prehistoric anthropology, and oriental antiquities, and in the section of helminthology and the historical collections. The total number of specimens in the Museum is now estimated to be 3,720,237. The figures for each department are given in the appended tables.

Number of specimens received in 1896–97.

Department.	Specimens.
Arts and industries:	
Materia medica	5
Animal products	1
Graphic arts	2
Transportation and engineering	3
Electrical collections	253
Naval architecture	5
Historical collections	3,441
Photographic collections	47
Musical instruments	50
Modern pottery, porcelain, bronzes, etc	143
Physical apparatus	1
Domestic animals	2
Ethnology	1,600
Pueblo collection	2,234
Oriental antiquities and religious ceremonials	628
Prehistoric anthropology	*a* 13,840
Mammals (skins and alcoholics)	1,011
Birds	4,947
Birds' eggs and nests	940
Reptiles and batrachians	1,158
Fishes	2,110
Mollusks	10,400
Insects	13,217
Marine invertebrates	2,371
Helminthological collection	*b* 2,949
Comparative anatomy:	
Mammals	110
Birds	
Reptiles and batrachians	
Fishes	

a In addition, a large quantity of aboriginal pottery, estimated at 20,000 specimens, has been transferred to this department.

b Number of catalogue entries during the year.

Number of specimens received in 1896-97—Continued.

Department.	Specimens.
Paleontology:	
Vertebrate fossils	5,300
Invertebrate fossils	
Paleozoic	
Mesozoic	
Cenozoic	
Fossil plants	
Recent plants	40,000
Minerals	1,341
Geology	3,801
Total	111,910

Number of specimens in the departments of the Museum on June 30, 1897.

Department.	Specimens.
Arts and industries:	
Materia medica	6,330
Foods	1,114
Textiles	4,942
Fisheries	10,080
Animal products	3,040
Graphic arts	5,622
Forestry	749
Transportation and engineering	1,914
Electrical collections	395
Naval architecture	1,326
Historical collections	54,799
Photographic collections	1,281
Musical instruments	1,393
Modern pottery, porcelain, bronzes, etc	4,008
Paints and dyes	197
Physical apparatus	367
Oils and gums	1,112
Chemical products	
Domestic animals	219
Ethnology	430,070
Pueblo collection	*a* 17,155
Oriental antiquities and religious ceremonials	3,618
Prehistoric anthropology	*a* 250,256
Mammals (skins and alcoholics)	16,223
Birds	104,487
Birds' eggs and nests	62,887
Reptiles and batrachians	36,777
Fishes	150,000
Mollusks	632,300
Insects	643,000
Marine invertebrates	528,700
Helminthological collection	*b* 4,499
Comparative anatomy:	
Osteology	15,395
Anatomy	

a The prehistoric pottery, with the exception of the pueblo series, has been transferred to the department of prehistoric anthropology. The number of specimens transferred is estimated at 20,000.

b Number of catalogue entries to June 30, 1897.

Number of specimens in the departments of the Museum on June 30, 1897—Continued.

Department.	Specimens.
Paleontology:	
Vertebrate fossils	322,112
Invertebrate fossils	
Fossil plants	
Recent plants	318,733
Minerals	28,898
Geology	76,205
Total	3,720,237

The following table shows the number of accessions annually since 1881:

Year.	Accession numbers (inclusive).	Number of accessions during the year.
1881	9890–11000	1,111
1882	11001–12500	1,500
1883	12501–13900	1,400
1884	13901–15550	1,650
1885 (January to June)	15551–16208	658
1886	16209–17704	1,496
1887	17705–19350	1,646
1888	19351–20831	1,481
1889	20832–22178	1,347
1890	22179–23340	1,162
1891	23341–24527	1,187
1892	24528–25884	1,357
1893	25885–27150	1,266
1894	27151–28311	1,161
1895	28312–29534	1,223
1896	29535–30833	1,299
1897	30834–32300	1,467

A complete list of the accessions for the year is printed in Appendix II.

CATALOGUE ENTRIES.

The number of catalogue entries made during the year was 67,097, more than double the number for the preceding year. The increase is most apparent in the departments of prehistoric anthropology, paleontology, and mammals. The entry figures for each collection are given in the following table:

Department.	Entries.
Arts and industries:	
Materia medica	5
Graphic arts	2
Transportation and engineering	3
Electrical collections	276

Catalogue entries—Continued.

Department.	Entries.
Arts and industries—Continued.	
Naval architecture	5
Historical collections	441
Musical instruments	[illegible]
Modern pottery, porcelain, bronzes, etc	[illegible]
Physical apparatus	1
Domestic animals	2
Ethnology	[illegible]
Pueblo collection	1,826
Oriental antiquities and religious ceremonials	59
Prehistoric anthropology	22,210
Mammals (skins and alcoholics)	11,079
Birds	4,947
Birds' eggs and nests	300
Reptiles and batrachians	[illegible]
Fishes	[illegible]
Mollusks	2,808
Insects	239
Marine invertebrates	[illegible]
Helminthological collection	2,949
Comparative anatomy:	
Mammals	
Birds	
Reptiles and batrachians	110
Fishes	
Paleontology:	
Vertebrate fossils	
Invertebrate fossils	
Paleozoic	
Mesozoic	14,723
Cenozoic	
Fossil plants	
Recent plants	[illegible]
Minerals	532
Geology	[illegible]
Total	67,097

APPROPRIATIONS FOR 1897–98.

The appropriations for the fiscal year ending June 30, 1898, are as follows:

Preservation of collections	$16[illegible]
Furniture and fixtures	30,000
Heating and lighting	14,000
Building repairs	4,000
Rent of workshops	2,000
Postage stamps	500
Galleries	8,000
Removal of sheds	2,500
Printing and binding	12,000
Total	233,000

This is an increase of $25,275 over the appropriation for the fiscal year just closed. The increase in the regular appropriation, however, is only $7,775, the remainder ($17,500) being for the removal of sheds and the purchase of furniture and fixtures for the galleries.

EXCHANGES OF SPECIMENS WITH INSTITUTIONS AND INDIVIDUALS ABROAD.

The exchanges which have occurred during the year with foreign museums and individuals have resulted in the acquisition of some very desirable material. Natural history specimens, as well as ethnological material, have been received from museums and individuals in different parts of the world. The principal exchanges, arranged to correspond with the order of the departments in the Museum, are here briefly referred to.

Mammals.—A skull of a bison has been sent to Mr. J. McNaught Campbell, Kelingrove Museum, Glasgow, Scotland, in return for archæological objects already received.

A specimen of *Tamias* and one of *Sciurus* have been received from Mr. G. D. Wilder, Pekin, China, for which birds' skins have been sent in return.

From the Berlin Zoological Museum, Berlin, Germany, a specimen of *Monophyllus redmanni* has been transmitted by Dr. Paul Matschie, in exchange for a specimen of *Ischnoglossa nivalis.*

Birds.—One hundred and seventy-two birds' skins from South Africa have been received from the Albany Museum, Grahamstown, South Africa, Dr. S. Schönland, director, in continuation of exchanges. An equivalent in birds' skins from the United States, Bahamas, and Labrador has been sent.

Prof. Jean Stolzman transmitted from the Branicki Museum, Warsaw, Russia, 152 birds' skins from Peru and Transcaspia, in continuation of exchanges.

Five birds' skins from Hungary have been received from Mr. Stefan Chernel von Chernelháza, Köszeg, Hungary, in return for material already forwarded by the Museum.

Ten specimens of redpolls have been received from Mr. J. H. Fleming, Toronto, Ontario, Canada. Seven birds' skins have been transmitted in return. Birds' skins from British Columbia have been received from the Provincial Museum, Victoria, British Columbia, through Mr. John Fannin. An equivalent in birds' skins has been sent in return.

A specimen of *Mixornis everetti* and a specimen of *Conurus xanthogenis* have been received from the Tring Museum, Tring, England. An equivalent has been transmitted.

From Mr. Victor Ritter von Tschusi zu Schmidhoffen, Hallein, Hungary, have been received 17 birds' skins, for which an equivalent has been sent.

From Mr. G. D. Wilder, Pekin, China, have been received 53 birds' skins, for which a collection of similar material has been transmitted in exchange.

Reptiles and batrachians.—A specimen of *Crotalus confluentus* has been sent to Mr. J. McNaught Campbell, Kelingrove Museum, Glasgow, Scotland, in return for archaeological objects received from him.

Fishes.—A collection of Gobioid and Blennioid fishes has been transmitted to the Australian Museum, Sydney, New South Wales, Mr. R. Etheridge, jr., curator, in continuation of exchanges.

Fishes representing 16 species have been forwarded to the Museo Civico di Storia Naturale, Genoa, Italy, Marquis Giacomo Doria, director, in continuation of exchanges.

A small collection of fishes has been received from the Museum of Natural History, Lyons, France, Mr. L. Lortet, director, in continuation of exchanges, and as a special return for fishes sent in 1895.

Gobioid fishes, representing 13 species, have been sent to Prof. F. A. Smitt, director, Zoological Museum, Stockholm, Sweden.

Mollusks.—Dr. R. Koehler, Lyons, France, transmitted 3 species of mollusks in continuation of exchanges.

Shells have been received from the Royal Academy of Science and Arts, Barcelona, Spain, Señor Arturo Bofill, secretary, and specimens of fossils and shells have been sent in return.

From Mr. Henry Sutor, Christchurch, New Zealand, have been received three alcoholic specimens of Unios and Unio shells. Unios from North America have been sent in exchange.

Insects.—To Dr. H. Friese, Innsbruck, Austria, have been sent 461 specimens of hymenoptera, representing 203 species.

One hundred and seventy-two specimens of Brazilian lepidoptera, representing 115 species, have been received from Mr. J. G. Foetterle, Petropolis, Brazil, for which publications will be sent in return.

Rev. J. H. Keen, Massett, Queen Charlotte Islands, British Columbia, has transmitted specimens of rare coleoptera, for which a partial return has been made.

From the Museum of Natural History, Geneva, Switzerland, through Dr. N. d'Adelung, have been received 84 specimens of orthoptera. Crustaceans have been sent in return.

Marine invertebrates.—Crustaceans representing 9 species have been received from the British Museum of Natural History, Sir William Flower, director, in continuation of exchanges.

Mr. H. Farquhar, department of lands and surveys, Wellington, New Zealand, has transmitted echinoderms from New Zealand, for which a specimen of *Asterias rupicola* has been sent in return.

From Dr. R. Koehler, Lyons, France, have been received 21 species of marine invertebrates from the Gulf of Gascogne, in continuation of exchanges.

A collection of crustaceans has been received from Prof. Wilhelm

Leche, Stockholm, Sweden, in return for material already forwarded by the Museum.

From the Museum of Natural History, Geneva, Switzerland, crustaceans have been received, and similar material has been sent in return.

Crabs, representing 72 species, have been received from the Museum of Natural History, Paris, France, Dr. A. Milne-Edwards, director. One hundred and thirty-nine crabs, from the United States, Mexico, Central America, and the West Indies, have been sent in exchange.

Thirty-two species of crabs have been received from the Royal Zoological Museum, Berlin, Germany, Prof. Karl Möbius, director, in continuation of exchanges.

The Royal Zoological Museum, Turin, Italy, transmitted decapod and other crustaceans in continuation of exchanges.

A collection of crustaceans has been received from the Zoological Institute, Kiel, Germany, Dr. K. Brandt, director, in return for crinoids, holothurians, and crabs recently forwarded by the Museum.

Thirty-two species of crabs have been received from the Zoological Museum, Copenhagen, Denmark, in return for crustaceans.

Helminthology.—Parasitic worms have been received in exchange from Dr. M. Kowalewski, Dublany près Léopol, Galicia, Austria, Prof. A. Railliet, Alfort, France, and Prof. Dr. F. Zschokke, Basel, Switzerland.

Comparative anatomy.—The skeleton of a sea otter has been received from Mr. J. M. Macoun, Geological Museum, Ottawa, Canada, for which a suitable return has been made.

Paleontology.—A collection of fossils has been sent to Dr. Hermann Credner, Paleontological Institute, Leipsic, Germany, in return for material already received from him.

A collection of English carboniferous pelecypods, representing 36 species, has been received from Dr. Wheelton Hind, Stoke-upon-Trent, England, for which fossil pelecypods have been sent in return.

Cambrian fossils have been sent to the Museum of Natural History, Paris, France, Dr. A. Milne-Edwards, director, in exchange for material already received.

From the Oxford University Museum, Oxford, England, have been received, through Dr. E. S. Goodrich, three casts of Stonefield fossil mammals and a cast of *Sphenodon punctatus*, for which an equivalent has been sent.

Shells and fossils have been forwarded to the Royal Academy of Science and Arts, Barcelona, Spain, Señor Arturo Bofill, secretary, in return for Mesozoic fossils.

Botany.—Through the Department of Agriculture a collection of dried plants has been received from Mr. R. T. Baker, Sydney, New South Wales.

From Mr. Alex. Batalin, St. Petersburg, Russia, have been received specimens of dried plants from Brazil and other localities, in return for which botanical specimens have been sent.

From the Botanical Museum, Berlin, Germany, a collection of plants from the Argentine Republic and Brazil and specimens of *Angelica medicana* have been received. An equivalent has been sent in return.

Dr. E. Warming, director Botanical Museum, Copenhagen, Denmark, transmitted a large collection of herbarium specimens in continuation of exchanges.

From Dr. A. Brick, Hamburg, Germany, has been received, through the Department of Agriculture, specimens of plants from Australia, Africa, and Europe.

Botanical specimens have been sent to Mons. Casimir de Candolle, Geneva, Switzerland, as an equivalent for material already received.

One hundred and seven specimens of dried plants have been received from Mons. C. Copineau, Doullens, Somme, France.

Specimens of Umbelliferæ have been sent to Mr. Oscar Druda, director Botanical Gardens, Dresden, Germany, in return for botanical specimens.

Botanical specimens have been transmitted to Prof. James Fowler, Kingston, Ontario, Canada, in return for material already received.

A specimen of *Sacoglottis amazonica* Mart. has been received in exchange from Mr. J. H. Hart, Botanical Garden, Trinidad, West Indies.

Specimens of *Juniperus occidentalis* have been received in exchange from the Royal Botanic Gardens, Kew, England.

Botanical specimens have been sent in continuation of exchanges to Prof. Dr. H. Pittier, Instituto Fisico-geografico Nacional, San José, Costa Rica.

Mons. S. E. Lassimonne, Moulins (Allier), France, has transmitted 223 plants in continuation of exchanges.

From Baron Ferd. von Müller, Melbourne, Australia, have been received in exchange several collections of Australian plants.

Botanical specimens have been forwarded to Mr. G. R. M. Murray, British Museum, London, England, and to Mr. José Ramirez, National Medical Institute, City of Mexico.

From the Royal Botanical Gardens, Calcutta, India, botanical specimens have been received in continuation of exchanges.

From the Imperial Royal Natural History Museum, Vienna, Austria, have been received 100 plants in continuation of exchanges.

Collections of plants have been sent to the Royal Botanic Gardens, Kew, England, Dr. W. T. Thiselton-Dyer, director, in continuation of exchanges.

From the Tiroler Botaniker, Die Freie Vereinigung, Oberdrauthale, Karnten, Austria, Hans Simmer, secretary, have been received 118 lichens, for which lichens, mosses, and ferns have been sent in return.

From the Zurich Botanical Garden, Zurich, Switzerland, botanical specimens have been received, and a suitable equivalent transmitted in return.

Prehistoric anthropology.—Mr. J. McNaught Campbell, Kelingrove Museum, Glasgow, Scotland, has received stone implements and shell

beads in exchange for material already transmitted to the U. S. National Museum.

Ten knives, scrapers, and a chipped bowlder have been received from the Canterbury Museum, Christchurch, New Zealand, Mr. F. W. Hutton, curator, in continuation of exchanges.

From Mr. J. de Morgan, Gizeh Museum, Egypt, a series of 252 specimens of prehistoric stone implements from Egypt has been received. An equivalent will be sent shortly.

Archæological objects have been forwarded, in continuation of exchanges, to Prof. H. H. Giglioli, director of the Royal Zoological Museum, Florence, Italy.

Ethnology.—Ethnological objects have been received, in continuation of exchanges, from the Canterbury Museum, Christchurch, New Zealand, Mr. F. W. Hutton, curator.

From Mr. G. Colini, Museo Prehistorico Etnografico, Rome, Italy, a model of a throwing-stick obtained from the Ozonana Indians of the Amazon district has been received. A suitable return has been made.

From the Royal Museum, Salford, Lancashire, England, Mr. B. H. Mullen, director, ethnological objects have been received in return for casts of prehistoric implements.

Oriental antiquities.—Eighteen objects, illustrating Buddhistic worship, have been received from St. John's College, Shanghai, China, Rev. F. L. Hawks Pott, president, in return for casts of prehistoric objects and botanical specimens already transmitted.

Minerals.—Mineralogical material has been received from the Royal Academy of Science and Arts, Barcelona, Spain, Señor Arturo Bofill, secretary, and shells and fossils have been sent in return.

Geology.—Specimens of nepheline-syenite and sodalite from York River, Dungannon, Ontario, Canada, have been received from Mr. F. D. Adams, McGill University, Montreal, for which geological material has been sent, in care of Mr. Adams, to the Peter Redpath Museum, McGill University.

Thirteen specimens of rocks have been received from Prof. H. Alleyne Nicholson, University, Aberdeen, Scotland, in exchange for geological material previously forwarded by the Museum.

COOPERATION OF THE EXECUTIVE DEPARTMENTS OF THE GOVERNMENT.

The courteous assistance which has been rendered to the Museum by the State Department and other Executive Departments and bureaus of the Government has been instrumental in adding much valuable material to the collections.

A collection of candlesticks and lamps obtained in China by Mr. A. E. Hippisley, commissioner of customs in China, has been received through the Department of State.

Hon. W. W. Rockhill, Assistant Secretary of State, presented a Korean idol to the Museum.

The Museum is much indebted to the Treasury Department for its continued assistance in connection with the prompt free entry of material from various foreign countries.

Portraits of Franklin, Henry, Morse, and Kendall have been received from the Bureau of Engraving and Printing.

Dr. Stejneger and Mr. Lucas, members of the Fur-Seal Investigation Commission, were given permission by the Secretary of the Treasury to kill a limited number of fur-seals on the coast of Alaska for the National Museum.

The Museum is indebted to Capt. J. J. Dunton, keeper, Life-saving station, Ocean City, Md., for a specimen of Angler, or Fishing Frog (*Lophius piscatorius*).

Several officers of the U. S. Army have secured material of various kinds for the Museum, consisting of natural history and botanical specimens and ethnological objects. Among those who have shown special interest in behalf of the Museum are Dr. Edgar A. Mearns, Dr. W. H. Forwood, Dr. J. C. Merrill, Capt. J. W. Pope, Capt. W. L. Carpenter, Lieut. Wirt Robinson, and Lieut. H. L. Willoughby. Dr. E. R. Hodge, of the Army Medical Museum, contributed specimens of Confederate paper money.

From the U. S. Signal Office, Gen. A. W. Greely, Chief Signal Officer, was received the Beardslee magneto-dial telegraph instrument.

The Museum is under obligations to several officers of the U. S. Navy for valuable contributions to the collections. Commander F. W. Dickins sent two clay pipes found in an Indian grave at Newport, Rhode Island. Commander S. D. Sigsbee transmitted a specimen of sea-lily obtained from near Havana. Lieut. C. G. Calkins secured for the Museum a collection of bamboo objects from Japan and some musical instruments from China.

Dr. James M. Flint has continued to act in the capacity of honorary curator of the section of materia medica.

Large collections of geological and other material obtained by field parties and individual geologists have been transmitted to the Museum collections by the U. S. Geological Survey. Special mention should be made of the material obtained by Prof. F. W. Clarke, Dr. W. H. Dall, Dr. David T. Day, Mr. J. S. Diller, Dr. W. F. Hillebrand, Dr. F. H. Knowlton, Whitman Cross, Dr. T. W. Stanton, David White, and others. Mr. Charles D. Walcott, Director of the Survey, transmitted gold-bearing quartz from Nevada. Large collections of Middle Cambrian medusæ and Middle Cambrian trilobites have also been made in Alabama under the direction of Mr. Walcott.

Four buffalo heads from animals killed by poachers in the Yellowstone Park, and ten photographs and sketches made by Mr. F. Jay Haynes, of Mammoth Hot Springs, Wyoming, have also been added to the Museum collections.

Mr. Porter D. Haskel, of the U. S. Patent Office, presented a specimen of *Chrysopsis falcata*.

Dr. Z. T. Daniel, of the Indian Office, has continued to favor the Museum with ethnological and other objects.

Mr. J. W. Paschal, of the U. S. Pension Office, transmitted a photograph of a Cherokee Indian girl.

Several collections have been received from the Fish Commission during the year. The cruises made by the steamer *Albatross* in the vicinity of the Hawaiian Islands, off the coast of Lower California, and the Galapagos Islands, as well as the explorations of the steamer *Fish Hawk*, have resulted in the addition of much valuable natural history material to the Museum. The material obtained by different field parties connected with the Commission has also been of an interesting nature. Important collections of fishes have been made by Prof. C. H. Gilbert, Stanford University; Prof. B. W. Evermann, Mr. C. H. Townsend, and others. A very interesting collection of bones and ornaments was discovered by Superintendent Leary, of the Fish Commission stations at San Marcos, Texas, while engaged in excavating for fish-ponds.

Numerous and varied collections have been received during the year from the Department of Agriculture. The increase in the botanical collections, under the care of Mr. Frederick V. Coville, has been very marked, and the results of his cooperation are gratifying.

Large quantities of botanical specimens from many sections of the country have been transmitted by individuals and special collectors connected with the Department of Agriculture.

Dr. L. O. Howard, entomologist of the Department of Agriculture, has continued to act as honorary curator of the Department of Insects in the National Museum. Messrs. Ashmead, Linell, and Coquillett rendered able assistance in determining the collections of Hymenoptera, Coleoptera, and Diptera. Mr. E. A. Schwarz has rendered valuable aid in the work of the Department of Insects.

Through Dr. C. Hart Merriam, chief of the Biological Survey, specimens of plants and other material have been received. A small collection of fishes, obtained in Mexico by Messrs. Nelson and Goldman, have been added to the Museum collections, and other specimens of various kinds, obtained by collectors connected with the Biological Survey, have also been received.

Among the most important collections which have been transmitted by the Bureau of Ethnology especial mention should be made of the collection of ethnological, entomological, and paleontological objects obtained by Dr. J. Walter Fewkes in Arizona and New Mexico, while engaged in explorations under the auspices of the Smithsonian Institution. The Hilder collection of antiquities has also been added to the Museum collection. It consists of material obtained from mounds in Missouri and Illinois. Mrs. M. C. Stevenson has transmitted plants and archæological objects gathered from Arizona, and among the Zuñi

Indians of New Mexico. A collection of archaeological specimens made by Prof. G. K. Gilbert in Colorado, ceremonial objects used in connection with the "Ghost Dance" of the Kiowa Indians, and numerous other collections of importance and value have also been received.

EXPLORATIONS.

Dr. William L. Abbott has extended his travels into Lower Siam, and has forwarded to the Museum two very large and exceedingly interesting collections, consisting of natural-history specimens and ethnological objects. In a communication concerning the ethnological objects obtained he gives a graphic description of the foot-gear found in that country, a number of examples of which have been added to the Museum collection. The material transmitted by Dr. Abbott includes many objects new to the collections, and among the natural-history material several new species have been discovered.

Dr. J. W. Fewkes, assisted by Dr. Walter Hough made additional ethnological collections in Arizona and New Mexico. The material already collected is of especial value, for the reason that it forms a connecting link between the modern and ancient culture of the tribes of Middle America.

Dr. David Starr Jordan, president of the Leland Stanford Junior University, transmitted, in behalf of the Fur-Seal Investigation Commission, a collection of natural-history specimens obtained by the Commission in Japan and Bering Seas. Dr. Leonhard Stejneger and Mr. F. A. Lucas, of the National Museum, were absent during the greater portion of the first half of the fiscal year on duty connected with this Commission, and during that time they collected a considerable quantity of material for the Museum. Dr. Stejneger extended his trip to Japan, Kamchatka, and the Sandwich Islands, making collections at all these places. Dr. Stejneger and Mr. Lucas again left for Alaska on June 5, 1897, having been detailed, by direction of the President, for further duty in connection with the Fur-Seal Investigation Commission.

Mr. Charles Schuchert, assistant curator of the Department of Paleontology, was, in October, 1896, authorized to visit Alabama and Mississippi in search of the remains of *Zeuglodon* and other fossil animals. Later in the year Mr. Schuchert proceeded to Marksboro, New Jersey, under instructions to inquire into the reported finding of mastodon remains at that place. After completing duties assigned to him in connection with the installation of the exhibit of the National Museum, and, incidentally, of the Geological Survey, at the Tennessee Centennial Exposition in the spring of 1897, Mr. Schuchert remained in the vicinity of Nashville for the purpose of making collections for the Museum.

Dr. D. W. Snyder, Nashville, Tennessee, who has been engaged in missionary work in Africa, obtained for the Museum a collection of ethno-

logical objects, including a model of a Mukete house. Dr. Snyder also obtained a very interesting collection of beetles from the interior of Africa. He proposes to return to that country, and has kindly offered to procure additional material for the Museum.

In May Mr. J. N. Rose, assistant curator of botany, was directed to proceed to Mazatlan, on the west coast of Mexico, for the purpose of gathering material for incorporation in reports on the botany and ethno-botany of the region extending from that point eastward across the low tropical country and over the Sierra Madre to the arid interior plateau. His investigations will be conducted in accordance with a plan outlined by the honorary curator of botany and approved by the Acting Assistant Secretary. It is hoped that the appropriations for the coming year will enable the continuance of his detail upon this work. The Mexican minister has graciously bespoken for Mr. Rose the kind offices of the Mexican officials in facilitating the transportation into the United States of any collections which he may obtain, and in aiding in other ways in the furtherance of his plans.

Additional collections of mammals, plants, invertebrates, and other material obtained by Dr. E. A. Mearns, U. S. A., in New York, Minnesota, Maryland, and Virginia have been added to the Museum collections.

Prof. O. F. Cook, of the National Museum, obtained, during his travels in Africa, valuable collections of flowers, ferns, and other botanical specimens, which have been added to the Herbarium.

Mr. Rolla P. Currie was detailed to accompany Professor Cook to Africa for the purpose of obtaining natural history collections and, more particularly, mammals, birds, insects, fishes, mollusks, and marine invertebrates. He was instructed to give especial attention, in addition, to protective mimicry among insects and to devote his efforts to securing objects and photographs illustrating the arts and industries of the Liberian natives. Mr. Currie left Washington in October, 1896, and was absent about seven months.

Valuable collections obtained by field parties and agents of the U. S. Fish Commission, the U. S. Department of Agriculture, and the U. S. Geological Survey have also been received.

COLLECTORS' OUTFITS.

Collecting outfits have been furnished during the year to the following persons: Prof. B. W. Evermann, of the U. S. Fish Commission, for collecting in Idaho; Mr. C. G. Rorebeck, Washington, D. C.; Mr. H. C. Oberholser, of the Department of Agriculture; Rev. P. H. Sörensen, Jakobshavn, Greenland; Dr. E. A. Mearns, U. S. A., for collecting in New York State; Dr. W. L. Abbott, Bombay, India; Mr. F. X. Holzner, San Diego, Cal.; Lieut. C. A. Clarke, U. S. S. *Thetis*, San Diego, Cal.; Dr. DeWitt Webb, St. Augustine, Florida, and Mr. George D. Wilder, Pekin, China.

Many of the members of the scientific staff of the Museum have engaged in field-work during the year, and have been supplied with suitable outfits.

DEVELOPMENT AND ARRANGEMENT OF THE EXHIBITION SERIES.

No changes of special importance have been made in the exhibition series during the year. A portion of the time of the curators was occupied in preparing exhibits for the Tennessee Centennial Exposition, and the work of constructing galleries in several of the halls and courts necessarily caused considerable disturbance, and effectually prevented any permanent improvements being made in the arrangement of the collections.

In the department of mammals a number of antlers of wapiti and caribou were hung on the walls, but otherwise the exhibition series remains practically unchanged. The collections are very much crowded and are in need of labels. The taxidermist in the department of birds has been engaged almost constantly during the year in cleaning specimens in the exhibition series and in supplying them with new supports and label-holders. The cases are not dust-proof, and constant care is necessary to keep the collection in good condition. The specimens are considerably crowded, but otherwise they present a better appearance than for some time past. Portions of the series have been rearranged; many new specimen labels have been supplied in place of species labels, and descriptive labels for families have been quite generally placed. A few specimens have been remounted, some of which were sent to the Tennessee Centennial Exposition. The exhibition series in the department of fishes remains much the same as heretofore; a few additions have been made during the year. The mounted series of mollusks has been enlarged, but is withdrawn temporarily for exhibition at Nashville. No material change has been made in the unmounted portion of the exhibition series. The collections on exhibition in the department of comparative anatomy are in excellent condition. A great deal of time has necessarily been devoted to rearrangement, owing to the disturbance caused by laying a new floor in this hall. A small collection of insects is still exhibited at the foot of the stairway leading to the offices of the department, no more suitable place being at present available.

Much time has been devoted to the exhibition series of fossil vertebrates and fossil plants, but these collections are still in a condition far from satisfactory. When the new gallery is finished, the former series will be considerably enlarged. That portion known as the "Marsh Collection" needs labeling, and the entire invertebrate exhibition series should be mounted on tiles.

The collection of gems has been remounted and installed in four cases instead of two, as heretofore. A case containing a series of specimens illustrating the mineralogy of Sussex County, New Jersey,

has been installed, and the entire collection of minerals has been supplied with new blocks. No changes of importance have been made in the exhibition series of the department of geology.

The time of the curator of ethnology has been so largely occupied with other matters that the exhibition series has received but little attention during the past few months. The construction of new galleries has interfered with the work, as in the case of several of the other departments. The collections are, however, in as good condition as circumstances will permit. A portion of the exhibition series is arranged ethnically and the remainder technically. In the American series objects belonging to each culture class are placed together. No special changes in the exhibit of the department of prehistoric anthropology have been made. Many new labels have been added, and others are in course of preparation.

The entire section of religious ceremonials of eastern Asia has been rearranged. In the Egyptian alcove six casts made from squeezes were added, and the colossal torso from Senjirli was placed in position. In the Assyro-Babylonian alcove the monuments from Palestine were installed.

The electrical collections have been classified and arranged, and an effort has been made to assemble and place on exhibition the Henry relics. A suitable case has been provided for their installation. A considerable number of pieces of Professor Henry's experimental apparatus have been received from the Smithsonian Institution, and the apparatus made by him in 1831 for Yale University has been deposited in the Museum. The exhibition series in the section of naval architecture has been rearranged with a special view to bringing together and in proper sequence models illustrating the same classes of vessels and showing their gradual development. In the sections of textiles and animal industries tentative exhibits have been prepared and installed. In the section of transportation and engineering the exhibition series is in fairly good condition, considering the limited space available. No changes of importance have been made during the year. The collection of materia medica has been carefully examined and in part rearranged. The Daguerre monument has been removed from the rotunda and placed in the grounds east of the Museum building.

LABELS.

During the year more than 200 requisitions were received from the various departments of the Museum, an increase of about 25 per cent over the preceding year.

The following work was done at the Government Printing Office upon requisition by the Museum: Printing 700 copies of specifications for supplies, 2,000 vouchers, and 300 labels; binding 181 volumes; ruling and cutting 25,000 catalogue cards; ruling, printing, and binding 25 record books.

There were printed on the Museum press 120,727 labels, representing 2,486 forms; 103,352 blanks, representing 73 forms; 36,500 letter heads, representing 7 forms; 15,575 envelopes, representing 10 forms, and 56,258 copies of miscellaneous matter, representing 34 forms; total, 332,412 items, representing 2,610 forms. Of the labels printed, 16,704, representing 1,945 forms, were for the exhibit of the Museum at the Tennessee Centennial Exposition.

LIBRARY.

The librarian, Dr. Cyrus Adler, states that the increase in the library has been larger than in any previous year, that more books have been withdrawn, and that the work of the library is progressing satisfactorily in all its branches.

The accessions for the year were as follows: Books, 707; pamphlets, 1,852; parts of periodicals, 13,635; total, 16,194. These figures include the publications retained from the accessions to the library of the Smithsonian Institution, which were as follows: Books, 373; pamphlets, 1,303; periodicals, 8,117. One thousand books belonging to the Smithsonian deposit were bound at the Government bindery, and 178 were bound at the expense of the Museum appropriation.

More than 9,000 books were borrowed during the year, of which 4,000 were assigned to sectional libraries.

The Smithsonian Institution has, as heretofore, rendered aid in securing the loan of books from the Library of Congress needed for reference in the Museum.

There are now twenty-one authorized sectional libraries, as follows:

Administration.
Birds.
Botany.
Comparative anatomy.
Ethnology.
Fishes.
Geology.
History.
Insects.
Mammals.
Marine invertebrates.
Materia medica.
Mesozoic fossils.
Mineralogy.
Mollusks.
Oriental antiquities.
Paleobotany.
Parasites.
Photography.
Prehistoric anthropology.
Reptiles.

An examination has been made of all these sectional libraries, and with a few exceptions they are in good condition and well cared for.

A list of the accessions to the library by gift and exchange, during the fiscal year ending June 30, 1897, is printed in Appendix III.

CONTRIBUTIONS OF THE YEAR TO SCIENTIFIC LITERATURE.

Many important monographs and papers, based upon Museum material, have been published during the year. The titles of these papers, together with abstracts of their contents, are printed in full in

Appendix IV. Eighty-seven authors are represented in this Bibliography. The following table shows the subjects to which the papers relate:

Subject.	By Museum officers.	By other investigators.	Total.
Administration	1	....	1
Archæology	7	6	13
Bibliography	1	....	1
Biography	1	....	1
Biology	1	....	1
Birds	15	19	34
Birds' eggs	....	1	1
Botany	18	11	29
Ethnology	11	7	18
Exploration	1	1	2
Fishes	5	10	15
Fossils	10	....	10
Geology	9	....	9
Insects	39	7	46
Mammals	4	7	11
Marine invertebrates	11	4	15
Mollusks	17	2	19
Parasites	3	....	3
Reptiles	1	1	2
Total	154	76	231

It has been found impracticable to issue hereafter "advance sheets" containing diagnoses of new species of animals, plants, minerals, etc., received in the Museum, as has been occasionally done in the past for the purpose of securing priority of publication. In order that prompt publication may still be secured, arrangements have been made whereby, when necessary, authors can publish such descriptions elsewhere, with the provision that this action first have the approval of the Secretary of the Smithsonian Institution.

PUBLICATIONS.

The Report of the Museum for 1894 was published during the year, and on June 30 the Report for 1895 was practically all in type. The manuscript for the administrative portion of the volume for 1896 is nearly ready for the printer. Volume XVIII of the Proceedings was issued in bound form, and papers 1069 to 1071 and 1083 to 1100, contained in this volume, have been distributed in the form of separates. Copies of the other papers belonging to this volume were issued prior to the commencement of the present fiscal year. Nos. 1101 to 1119, inclusive, of Volume XIX have also been published, together with advance editions of five papers (Nos. 1126–1129 and 1132 belonging to Volume XX.[1]

[1] The titles of all the separate papers issued during the year are given in Appendix V.

In the series of Bulletins two numbers have been issued—No. 47, the first part of an elaborate work entitled The Fishes of North and Middle America, by David Starr Jordan and Barton W. Evermann, and No. 49, Bibliography of the Published Writings of Philip Lutley Sclater, F. R. S., secretary of the Zoological Society of London, prepared under the direction of the late Dr. G. Brown Goode.

Two important monographs have been issued as Special Bulletins. The first of these consists of a work on the deep sea and pelagic fishes of the world, by Drs. G. Brown Goode and Tarleton H. Bean. This volume (Special Bulletin No. 2) contains 553 pages, and is accompanied by an atlas of 123 plates. The second (Special Bulletin No. 3) constitutes volume 2 of the late Major Bendire's Life Histories of North American Birds, and contains 518 pages and 7 colored plates. These works have been reprinted by the Smithsonian Institution as Volumes XXX, XXXI, and XXXII of Contributions to Knowledge.

MATERIAL LENT FOR INVESTIGATION.

Two specimens of bats were sent to Dr. Harrison Allen, Philadelphia, Pennsylvania, for use in connection with his studies of the Chiroptera. Dr. J. A. Allen, of the American Museum of Natural History, made use of about thirty specimens from the National Museum in the preparation of a paper on the mammals of Central America. Twenty-seven specimens of mammals were sent to Dr. C. Hart Merriam, chief of Biological Survey, Department of Agriculture, and Mr. G. S. Miller, jr., of the same Department, borrowed a number of bats for use in monographic work, besides several other specimens. One of these was made the type of a new species. Twelve skins and skulls of shrews were sent to Mr. E. W. Nelson. Mr. S. N. Rhoads, of the Academy of Natural Sciences, Philadelphia, received 40 skins of flying squirrels and 11 East African mammals for study.

The following material has been sent out by the department of birds for study and investigation: To Mr. C. B. Cory, Hyannis, Massachusetts, 13 bird skins; to Mr. Frank M. Chapman, American Museum of Natural History, New York City, 19 bird skins as an aid in the determination of Mexican birds; also 9 specimens for use in connection with the identification of South American birds; to Mr. Witmer Stone, Academy of Natural Sciences, Philadelphia, 69 specimens of Meadow Larks (*Sturnella*) for use in a study of the genus, and a specimen of Horned Owl; to Mr. Joseph Grinnell, Pasadena, California, 75 specimens of Goldfinches for use in a revision of the western subspecies; to Mr. Edwin Sheppard, Academy of Natural Sciences, Philadelphia, 11 specimens of game birds for use in illustrating a work by Prof. D. G. Elliot, of the Field Columbian Museum; to Mr. Osbert Salvin, London, England, 4 specimens of owls for examination; to Mr. L. M. Loomis, of San Francisco, California, 9 specimens of Leach's Petrel; to Prof. A. Newton, Cambridge, England, 2 specimens of *Bebrornis*; to Mr. William

Brewster, Cambridge, Massachusetts, 8 specimens for examination, and to Mr. W. E. Brooks, Mount Forest, Ontario, 2 specimens for identification.

Specimens of west coast sharks were sent to Dr. C. H. Gilbert, Stanford University, California; also specimens of sculpins from Bering Sea. A plaster cast of a brook-trout was sent to the American Museum of Natural History; 6 young specimens of *Hydrolagus colliei* to Dr. Bashford Dean, New York City, and a number of specimens of gobioid fishes to the Academy of Sciences, Stockholm, Sweden. Duplicate named specimens of mollusks were lent to Mr. H. A. Pilsbry, of the Academy of Natural Sciences, Philadelphia, and to Mr. B. H. Wright, Penn Yan, New York, for use in connection with their investigations of *Dentalium*, *Bulimulus*, and *Unio*.

Dr. W. McM. Woodworth, Museum of Comparative Zoology, Cambridge, Massachusetts, is making a special study of the Turbellarians and Nemerteans, and the entire collection in the National Museum has been transmitted to him. The collection of leeches has been sent to Mr. J. Percy Moore of the University of Pennsylvania, who has nearly completed a report upon the same. Sixty-three microscopic slides of Plumularidæ were sent to Prof. C. C. Nutting of the State University of Iowa. These are types of species described by Professor Nutting in his monograph of the Plumularian Hydroids, now nearly ready for the press. Mr. F. S. Morton, Portland, Maine, received several small lots of unassorted Foraminifera; also a number of species mounted for microscopic study. Two lots of Solenogasteridæ were sent to Prof. A. Agassiz for the use of Dr. Kofoid, who is studying the material of that group collected by the *Albatross*. A cranium of a fossil skate was sent to Dr. C. R. Eastman, Museum of Comparative Zoology, who described it as a new genus and species, and named it *Tamiobatis vetustus*.

From the department of insects the following material has been lent: Homoptera, belonging to the family Typhlocibidæ, to Prof. C. P. Gillette, Fort Collins, Colorado; Homoptera, belonging to the families Jassidæ and Cercopidæ, to Prof. Carl F. Baker, Fort Collins, Colorado; specimens of bees of the genus *Prosopis*, to Prof. T. D. A. Cockerell, Las Cruces, New Mexico; the collection of Acronyctas, to Prof. John B. Smith, New Brunswick, New Jersey; a series of Odonata, to Prof. D. S. Kellicott, Ohio State University, Columbus, Ohio; one species of the genus *Corixa* to Prof. H. Garman, Lexington, Kentucky; the collection of Ixodidæ, with manuscripts, bought from the heirs of Dr. George Marx, to Prof. G. Neumann, Toulouse, France, for monographic study.

Specimens of plants have been sent to the following persons for study and determination: Mr. W. W. Ashe, State Geological Survey, Raleigh, North Carolina; Mr. E. G. Baker, British Museum, London, England; Mr. T. S. Brandegee, San Diego, California; Mr. George

Davenport, Medford, Massachusetts; Mr. A. A. Eaton, Seabrook, New Hampshire; Dr. N. M. Glatfelter, St. Louis, Missouri; Mr. J. M. Greenman, Cambridge, Massachusetts; Mr. Theo. Holm, Washington, District of Columbia; Dr. C. F. Millspaugh, Field Columbian Museum, Chicago, Illinois; Dr. B. L. Robinson, Cambridge, Massachusetts; Mr. P. A. Rydberg, Columbia University, New York City; Mr. C. S. Sargent, Jamaica Plain, Massachusetts; Dr. J. K. Small, Columbia University, New York City, and Prof. John Donnell Smith, Baltimore, Maryland.

To Prof. Alpheus Hyatt, Cambridge, Massachusetts, were sent 51 specimens of Fort Cassin cephalopods and 29 specimens of *Placenticeras* to aid him in the preparation of a synopsis of the class Cephalopoda. A few specimens and slides of Bogosloff and Alaskan rocks were lent to Mr. C. W. Purrington, of the U. S. Geological Survey.

Photographs and drawings of Museum cases and information regarding their construction have been furnished to the following: Mr. F. H. Gerrodette, director of the Carnegie Museum, Pittsburg, Pennsylvania; Mr. C. H. Hitchcock, Dartmouth Museum, Dartmouth, New Hampshire; Mr. H. L. Preston, Rochester, New York; Mr. W. H. Bishop, Delaware College, Newark, Delaware; Mr. F. J. V. Skiff, director of the Field Columbian Museum, Chicago, Illinois; Woman's College, Baltimore, Maryland, and Mr. H. Nehrling, Public Museum, Milwaukee.

WORK OF STUDENTS AND INVESTIGATORS AT THE MUSEUM.

Dr. E. A. Mearns, U. S. A., has continued his studies of the mammals collected in connection with the survey of the Mexican boundary. He has already published several preliminary papers in the Proceedings of the Museum, and later a general treatise on the vertebrate animals of that region will probably be issued. Mr. C. H. Townsend, of the U. S. Fish Commission, studied the series of Bald Eagles; Mr. C. B. Cory, Hyannis, Massachusetts, examined some West Indian pigeons, and Mr. E. W. Nelson, of the Department of Agriculture, made extensive studies of Mexican birds in connection with the identification of the large amount of material collected by him in Mexico and Guatemala. Dr. A. K. Fisher, of the Department of Agriculture, examined numerous types in connection with his official work, and Messrs. H. C. Oberholser and W. H. Osgood, of the same Department, made use of the Museum collections on a number of occasions. Mr. William Palmer, chief taxidermist of the Museum, studied birds from the Pribilof Islands in order to ascertain the status of some of the forms. Dr. David S. Jordan examined the collection of fishes from Bering Sea, comparing the material with recent collections made by the Fur-Seal Investigation Commission. Dr. B. W. Evermann made extensive use of the collections in connection with the preparation of Bulletin 47, by Jordan and Evermann, on the "Fishes of North and Middle America." He also made compari-

sons with species recently obtained by the Commission. Dr. Bashford Dean, of New York City, examined certain Chimæroid fishes, and Prof. S. E. Meek studied collections from the Pacific slope. Dr. W. C. Kendall, of the U. S. Fish Commission, made comparisons with recent acquisitions by the Commission.

Mr. T. Wayland Vaughn, of the U. S. Geological Survey, has had the use of the entire collection of Eocene corals in connection with his researches in that group, and Prof. G. D. Harris, of Cornell University, utilized material in the Museum in connection with his work on the Lower Eocene faunas. The collections of the department of comparative anatomy have been studied at various times by students from medical colleges and the city high schools. Mr. Samuel J. Holmes, of the University of Chicago, who is preparing a list of the crustaceans of the west coast of the United States for publication by the California Academy of Sciences, spent a short time at the National Museum in examining and comparing specimens. Miss Harriet Richardson has aided in the identification of the Isopoda, especially the Sphæromidæ. Dr. Albert Hassall, of the Bureau of Animal Industry, Department of Agriculture, and Dr. Murray Galt Motter have prosecuted investigations upon the material in the section of helminthology.

The collections of the National Herbarium have been used by a number of specialists not connected with the Museum. Dr. N. L. Britton, of New York City, made three visits to Washington in order to settle certain points in connection with plants described in one of his works; Prof. F. W. Card, Lincoln, Nebraska, studied the genus *Ribes;* Prof. J. M. Coulter, Chicago, Illinois, spent several days in the study of the Umbelliferæ, and Miss Clara E. Cummings, Wellesley, Massachusetts, examined the cryptogamic collections. Prof. E. L. Greene, of the Catholic University of America, made frequent visits to the Herbarium, chiefly for the purpose of studying various types of Compositæ. Many specimens of *Astragalus* were determined by Mr. Marcus E. Jones, Salt Lake City, Utah. Mr. John B. Leiberg, a field agent of the Department of Agriculture, devoted several months to the determination of material collected in Oregon and Idaho. The collections were also utilized for comparison or for other purposes by Dr. C. F. Millspaugh, Ithaca, New York; Mr. W. L. Jepson, Berkeley, California; Prof. C. S. Sargent, Jamaica Plain, Massachusetts; and Mr. K. M. Wiegand, Ithaca, New York.

Dr. R. R. Gurley, of Worcester, Massachusetts, has continued his study of the graptolites in connection with the monograph which he has in preparation for the U. S. Geological Survey. Dr. T. G. White, Columbia College, New York City, visited the Museum in March for the purpose of studying the collection of Trenton fossils. The ammonites were examined by Prof. Alpheus Hyatt, Cambridge, Massachusetts. The geological material collected by Dr. E. A. Mearns along the line of the Mexican boundary has been worked up by Dr. E. C. E. Lord, of

the U. S. Geological Survey. Mr. Thomas Means, of the Division of Soils, Department of Agriculture, was engaged for a short time in the study of micro chemical methods for the determination of minerals, and Dr. A. S. Eakle, Washington, D. C., spent some time in an examination of the topaz crystals. Dr. Eakle has prepared a paper embodying the results of his studies, which will be published in the Proceedings of the Museum.

Mr. E. W. Nelson, Dr. W. J. Hoffman, and Dr. J. Walter Fewkes have carried on investigations of much importance in the department of ethnology. Mr. Nelson was engaged in the preparation of a monograph of the material collected by himself in Alaska some years ago; Dr. Hoffman has given his time to the pictographic work of the Eskimo, and Dr. Fewkes has been engaged in the preparation of an elaborate report upon the material which he recently collected in Arizona. Mr. J. D. McGuire, of Ellicott City, Maryland, has continued his work on aboriginal pipes. Mr. Charles Richards Dodge, of the Department of Agriculture, studied the fiber fabric from Lake Tanganyika, Central Africa, and Miss Georgie Leonard, of Washington, studied various South American antiquities. Countess Louise Ross, of the German embassy, and Miss Tuckerman, of Washington, made numerous visits to the Museum in connection with certain archaeological studies. The Washington relics, and other portions of the historical collections, have been frequently examined by students of history. Several persons have visited the department of oriental antiquities in order to acquire special information.

VISITORS.

The following table shows the number of visitors to the Museum and Smithsonian buildings for each month of the fiscal year ending June 30, 1897:

Year and month.	Museum building.	Smithsonian building.
1896.		
July	46,031	24,361
August	12,817	5,149
September	14,879	6,801
October	13,850	6,611
November	10,637	5,074
December	13,218	5,762
1897.		
January	10,298	5,126
February	13,049	5,600
March	43,483	25,740
April	21,504	10,835
May	15,383	8,127
June	14,457	6,523
Total	229,606	115,709
Approximate daily average on a basis of 313 days in the year	733	370

Number of visitors to the Museum and Smithsonian buildings since the opening of the former in 1881.

Year.	Museum building.	Smithsonian building.	Total to both buildings.
1881	150,000	100,000	250,000
1882	167,455	152,744	320,199
1883	202,188	104,823	307,011
1884 (half year)	97,661	45,565	143,226
1884–85 *a*	205,026	105,993	311,019
1885–86	174,225	88,960	263,185
1886–87	216,562	98,552	315,114
1887–88	249,665	102,863	352,528
1888–89 *a*	374,843	149,618	524,461
1889–90	274,324	120,894	395,218
1890–91	286,426	111,669	398,095
1891–92	269,825	114,817	384,642
1892–93 *a*	319,930	174,188	494,118
1893–94	195,748	103,910	299,658
1894–95	201,744	105,658	307,402
1895–96	180,505	103,650	284,155
1896–97 *a*	229,606	115,709	345,315
Total	3,795,733	1,899,613	5,695,346

a Years of Presidential inaugurations.

MATERIAL RECEIVED FOR EXAMINATION AND REPORT.

There has been an increase of nearly 25 per cent in the number of "lots" of material received for identification, the total for the present year having been 716. The record for the year covered by the last report also showed a considerable increase over that for the year preceding.

In Appendix VI a list of the material received during the present year is presented.

MEETINGS OF ASSOCIATIONS IN WASHINGTON DURING THE YEAR.

The annual meeting of the Society of Agricultural Chemists was held in the lecture hall of the Museum November 6, 7, and 9, 1896.

On December 11, Dr. David Starr Jordan delivered a lecture on the seal fisheries.

The Geological Society of America held its ninth annual meeting in Washington, December 29–31. During the second and third days the sessions were held in the lecture hall of the Museum.[1]

Mr. J. S. Diller, of the U. S. Geological Survey, delivered a lecture on "Crater Lake, Oregon," January 8, 1897.

A memorial meeting was held in the lecture hall of the Museum on February 13, under the auspices of the Joint Commission of Scientific Societies and the patriotic and historical societies of Washington, to

[1] The titles of the papers presented are given in Appendix VII.

commemorate the life and services of Dr. G. Brown Goode. Another volume of this Report will contain a full account of this meeting.

The Washington Camera Club gave an exhibition of lantern slides in the lecture hall on the evening of February 23.

On April 7 and 8 the National Science Club held its third annual meeting, using the lecture hall of the Museum for a portion of its sessions.[1]

The National Academy of Sciences held its annual meeting in the Museum building. The Academy remained in session four days, from April 20 to 23.[1]

The fourth triennial congress of American Physicians and Surgeons opened in Washington on May 4.

The series of Saturday lectures was continued under the auspices of the Joint Commission of Scientific Societies. The addresses were illustrated by the stereopticon and by maps, diagrams, and specimens. The lectures were arranged in two courses; the first on hydrography, and the second on current topics.

The following table indicates the number and dates of Saturday lectures since 1882:

Year.	Date of first and last lecture.	Number of lectures.
1882	Mar. 11, Apr. 29	8
1883	Jan. 13, Mar. 31	12
1884	Jan. 5, Apr. 26	17
1885	Feb. 7, May 2	12
1886	Mar. 6, May 8	10
1887	Mar. 12, May 7	12
1888	Feb. 18, May 5	12
1889	Mar. 9, May 11	10
1890	Feb. 1, Apr. 3	10
1891		
1892		
1893	Mar. 25, May 26	8
1894	Feb. 17, May 26	15
1895	Feb. 23, Apr. 27	10
1896	Mar. 21, May 23	10
1897	Mar. 13, May 1	8
	Total	154

The titles of Saturday lectures for the season of 1897 are given in Appendix VII.

NATIONAL HERBARIUM.

The employees of the Department of Agriculture assigned to the National Herbarium were transferred to the Museum on July 1, 1896, in accordance with a provision of the sundry civil appropriation act for the current year.

[1] The titles of the papers presented are given in Appendix VII.

NEW MUSEUM BUILDING.

A bill appropriating the sum of $250,000 for an additional Museum building, introduced by Senator Morrill in the first session of the Fifty-fourth Congress, was taken up in regular course on January 23, 1897, but was passed over without action.

TENNESSEE CENTENNIAL EXPOSITION.

The sum of $14,500 was allotted to the Smithsonian Institution and National Museum from the amount appropriated by Congress ($130,000) for an exhibit of the various Governmental departments at the Tennessee Centennial Exposition, to be held in Nashville from May 1 to October 31, 1897. The amount allotted to the Museum was afterwards slightly increased. Dr. F. W. True was designated representative for the Institution and Museum on the Government board of management. Mr. W. V. Cox represents Dr. True at Nashville, and has also been appointed secretary of the Government board.

An extended account of the participation of the Institution and Museum in the Exposition will be presented in the next annual report.

TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.

An appropriation of $200,000 has been made by Congress for a Government exhibit at the Trans-Mississippi and International Exposition at Omaha, Nebraska. This exposition will open in June, 1898, and continue for five months.

INTERNATIONAL EXPOSITION AT PARIS.

An invitation to participate in the International Exposition to be held in Paris in 1900 has been extended to the United States by the French Republic, and an appropriation of $25,000 has been made by Congress to cover preliminary expenses in securing appropriate space for the exhibits from this country.

NECROLOGY.

In another part of this Report will be found an extended account of the life and work of the late Dr. G. Brown Goode, Assistant Secretary of the Smithsonian Institution, who died on September 6, 1896. A memorial meeting was held in the lecture hall of the Museum on February 6, 1897, under the auspices of the Joint Commission of Scientific Societies and in cooperation with the patriotic and historical societies of Washington.

Mr. W. C. Winlock, honorary curator of the section of physical apparatus in the National Museum, died at Bay Head, New Jersey, on September 20.

Mr. Winlock was born on March 27, 1859, at Cambridge, Massachusetts, where he lived until his graduation from Harvard University in 1880. Shortly afterwards he accepted an appointment as assistant astronomer in the U. S. Naval Observatory, and his connection with that establishment continued until 1889, when he entered the service of the Smithsonian Institution as curator of the Bureau of International Exchanges. About two years later he was made assistant in charge of office in the Institution.

Mr. Winlock continued to interest himself in astronomical work, and at the time of his death he occupied the chair of astronomy in the Corcoran Scientific School and also in the Graduate School of Columbian University. Scientific papers written by him have appeared in the publications of the Smithsonian Institution, the Naval Observatory, the proceedings of the American Academy of Arts and Sciences, and in foreign scientific journals. He devoted much attention to the bibliography of astronomy, and also published several papers of a popular nature. During recent years his administrative duties occupied a large portion of his time, although he always cherished the hope that at a later period he would be able to devote himself more completely to his chosen work—a hope that was never realized.

Mr. Winlock was for many years secretary of the Philosophical Society of Washington. He was a fellow of the American Association for the Advancement of Science and a member of the Astronomische Gesellschaft, of Leipsic. He was also a member of the Society of the Sons of the American Revolution, and for a long period was secretary of the Cosmos Club, of Washington.

On February 4, 1897, Maj. Charles Bendire, U. S. A. (retired), died at Jacksonville, Florida.

Major Bendire held for a number of years the position of honorary curator of the department of birds' eggs in the National Museum. He was born in Hesse-Darmstadt, Germany, April 27, 1836, his German name being Karl Emil Bender. He came to the United States in 1852, and in 1854 enlisted in the army under the name of "Charles Bendire." After thirty-two years of service he was retired in 1886 on account of disability. He took an active part in the Indian wars in the West, and in 1890 was brevetted major for gallant services rendered during a fight with the Indians at Cañon Creek, Montana, in 1877. He also led a number of expeditions in connection with the work of laying out roads, surveying routes for telegraph lines, etc. In 1867 he crossed Death Valley, California, and explored the deserts of the southern part of Nevada. The large amount of time thus spent in the field gave him ample opportunity for scientific observation.

At the request of Professor Baird he assumed charge of the collection of birds' eggs in the National Museum in 1884, and soon afterwards undertook its entire rearrangement, which resulted in placing the series in excellent condition for study and reference. His own collection of

about 8,000 specimens of birds' eggs, obtained during his army service in the West, ranks as one of the most important gifts to the Museum. Moreover, the intense zeal which he displayed in his chosen field of labor inspired others to lend their generous aid in the work of building up the department under his charge. He was conspicuous for the methodical and careful manner in which all his undertakings were carried on, and particularly so in connection with his scientific investigations.

The most important of Major Bendire's published works is entitled Life Histories of North American Birds, issued by the U. S. National Museum in two quarto volumes. It is a matter of sincere regret and a great loss to ornithology that this work could not have been completed before his death; but although incomplete, this elaborate monograph will remain a lasting monument to his memory.

Mr. Martin L. Linell, aid in the department of insects, died on May 3, 1897.

Mr. Linell was born at Grönby, Sweden, June 24, 1849, and was educated at the University of Lund. Early in life he showed great interest in biology, and soon after coming to America, in 1879, he resumed his studies, confining himself mainly to the study of entomology. He became connected with the National Museum in 1889, and, although since that time he worked over and arranged a very large part of the collection of insects, it was to the order Coleoptera that his attention was especially given, and all of his published papers were upon that subject. It is to be regretted that at the time of his death he had only just begun the publication of the results of his work of many years.

Mr. Henry Horan, superintendent of buildings, died on September 29, 1896.

Mr. Horan had been connected with the Smithsonian Institution and National Museum since 1857, and during this long period of faithful service he had the entire confidence of his official superiors and the esteem and respect of all who were brought in contact with him.

Prof. Edward D. Cope, of Philadelphia, one of the most eminent of American naturalists, and a correspondent and collaborator of the National Museum, died on April 12, 1897.

Professor Cope's researches covered a wide field, and his contributions to scientific literature were varied and extensive. His special attention was given to the study of ichthyology, herpetology, mammalogy, and philosophy, and the results of his studies in these sciences are contained in twenty octavo and three large quarto volumes. Among his most important works the following may be mentioned: "The Batrachia of North America," published by the National Museum (1889); "Observations on the Systematic Relations of Fishes," published in the Proceedings of the American Association for the Advancement of Science (1871); "On the Classification of the Extinct Fishes of the Lower Types," published in the same journal (1887); "The Relations of

the Horizons of Extinct Vertebrata of Europe and North America" (1879); "The Origin of the Fittest" (1887), and "The Primary Factors of Organic Evolution."

A complete bibliography of his writings is in preparation under the auspices of the National Museum, and an elaborate monograph of the Reptilia of North America, which he had completed shortly before his death, will be published by the Museum.

Professor Cope was president of the American Association for the Advancement of Science, editor of the American Naturalist, and a member of the faculty of the University of Pennsylvania.

III.—REVIEW OF WORK IN THE SCIENTIFIC DEPARTMENTS.

DEPARTMENT OF MAMMALS.

Since the death, in September, 1896, of Dr. G. Brown Goode, the assistant secretary, the time of Dr. F. W. True, curator of mammals, has been occupied almost exclusively with the administrative work of the Museum. Dr. True states that the department has been without a regular force at times, and throughout the year there has been no officer on duty higher than an "aid." Under these circumstances it has been possible to do very little more than preserve the collections intact and prevent the routine work from accumulating.

The exhibition series has remained practically unchanged during the year. A number of antlers have, however, been hung on the walls. The specimens in the cases are very much crowded, and little could be done to improve the general appearance, while it has seemed undesirable to increase the series by adding freshly mounted specimens. The collection is still much in need of labeling. This is especially true of the foreign mammals, of which there are but few specimens for comparison in the study series. The American series needs relabeling, on account of the recent extensive changes in nomenclature, but the curator has not found time for this work during the year.

The study series is in fair order, but could be rendered more accessible if additional cases and more space in which to arrange them, could be provided. At present it is impossible to carry anything like a natural sequence from case to case.

More storage cases are needed for the larger mammals, many specimens of which are now exposed to dust.

The arrangement of the collection of medium-sized skulls has progressed, but has not yet been finished.

Considerable work has been done on the alcoholic collection, and the smaller species are in fair order. There are still many jars of the larger forms (rabbits, weasels, and the like) which need overhauling. It will be necessary to reconstruct the storage shelves on which these specimens are placed, before the latter can be properly arranged.

The accessions for the fiscal year just closed do not compare favorably with those of previous years, either in number or value. No new sources of supply have developed, and for the reasons above set forth the curator has been unable to give special attention to the matter of

increasing the collections. As stated in previous reports, it is especially necessary that more money be provided for the purchase of specimens for the department of mammals.

The accessions of greatest importance are as follows:

An excellent general collection from lower Siam, consisting of 165 specimens, was presented by Dr. W. L. Abbott, to whom the Museum is already so much indebted for valuable material. Two skins of the Mount St. Elias bear were obtained by purchase. Dr. E. A. Mearns, U. S. A., presented valuable collections from the Catskill Mountains and from the vicinity of the District of Columbia, amounting in all to 385 specimens. There was also obtained by purchase an excellent series of skins and skeletons of lemurs and other Madagascan mammals. Two specimens of the recently described pigmy African flying squirrels, genus *Idiurus*, were obtained from Mr. William B. Filer. They are from Efulen, Cameroons district, and appear to represent a new species. A number of skins of the larger lemurs, not previously represented in the collection, were purchased, and in the same manner three skeletons and a skull of *Globiocephala brachyptera* were obtained.

Mr. William Palmer and Mr. D. W. Prentiss, jr., both of the National Museum, collected a number of mammals in the District of Columbia and vicinity, and in the Dismal Swamp, Virginia. Nine fur seals were collected by Dr. Leonhard Stejneger, and Mr. F. A. Lucas obtained twelve skulls of the same animal on the Pribilof Islands. Six other members of the Museum staff have also sent in from one to four specimens each.

The Kent Scientific Institute, Grand Rapids, Michigan, through Mr. C. A. Whittemore, curator, lent for study a young specimen of a very rare *Bassaricyon* from Honduras.

During the early part of 1897 the preparation of an exhibit of mammals for the Tennessee Centennial Exposition was begun. This exhibit, as finally installed, consisted of a group of Proboscis monkeys, a group of gibbons, and a number of mounted specimens of lemurs, exhibited in two unit cases.

A monograph or revision of the American moles was published by the curator during the year. The manuscript of a paper on the antlers of the American deer has been nearly completed, but the work has necessarily been suspended for the present. The proper nomenclature of the whalebone whales has occupied the curator's attention during such time as he could devote to the subject.

Dr. E. A. Mearns, U. S. A., has continued his studies of the mammals collected during the survey of the Mexican boundary, and has published the results in several preliminary papers in the Proceedings. The titles of these papers are given in the Bibliography (Appendix IV). A general treatise on the vertebrate animals of the Mexican boundary, by Dr. Mearns, will probably be published in the form of a bulletin. Valuable assistance on technical matters has been rendered by Dr.

Mearns at such times as the curator could not give personal attention to details.

Mr. D. W. Prentiss, jr., has rendered volunteer service while not on the staff of the Museum.

During the year 1,011 specimens were received, the total number in the collection now being 16,223. In the catalogue of the regular series 1,011 entries have been made, and in the catalogue reserved for the deposit of the Department of Agriculture there were 10,068 entries during the year.

DEPARTMENT OF BIRDS.

Mr. Robert Ridgway, curator of the department of birds, states that there were 118 permanent accessions during the year, being 32 more than during the preceding year. In addition there were 87 "temporary" accessions, consisting of material received for examination and report. It is especially gratifying to note that several of the accessions contain material new to the collections, and of great value. One collection included 55 species and 3 genera new to the Museum series. The material received from Dr. W. L. Abbott embraced several specimens of species hardly represented in the collection.

The following accessions are worthy of special notice:

From Dr. W. L. Abbott, 458 bird skins collected in Lower Siam (gift); the Branicki Museum, Warsaw, Russia, 152 bird skins from South America and Transcaspia (exchange); Albany Museum, Grahamstown, South Africa, 135 bird skins (exchange); 111 bird skins from Patagonia (purchase); 105 specimens from Madagascar (purchase); 60 specimens from West Africa (purchase); 163 specimens from Florida (purchase); from Mr. George D. Wilder, Peking, China, 53 bird skins from North China (exchange); Hon. W. P. Brownlow, House of Representatives, Washington, District of Columbia, 49 bird skins from British Guiana (deposit); 203 specimens from tropical America (purchase); 328 specimens from the United States (purchase); Provincial Museum, Victoria, British Columbia, 97 bird skins from British Columbia (exchange); Mr. A. W. Anthony, San Diego, California, 22 bird skins from the islands off Lower California (exchange), also 8 bird skins from the same localities (gift); Albany Museum, Grahamstown, South Africa, 37 bird skins (exchange); Australian Museum, Sydney, New South Wales, 25 bird skins from Australia (exchange); Dr. E. A. Mearns, U. S. A., 84 bird skins from New York State (gift); Mr. E. A. McIlhenny, Avery Island, Louisiana, 26 bird skins from Louisiana (gift); California Academy of Sciences, San Francisco, 12 specimens of *Puffinus griseus* (exchange); Mr. A. Boucard, Isle of Wight, England, 1 specimen (gift); Mr. R. C. McGregor, Palo Alto, California, 68 bird skins from the western portion of the United States (gift); Dr. Leonhard Stejneger, U. S. National Museum, 18 bird skins from Japan; Mr. H. P. Attwater, San Antonio, Texas, 11 bird skins from Texas (purchase); Mr. A. W. Anthony, San Diego, California, 3 types of new species (deposit); Dr. E. Coues, Washington, District of Columbia, type of *Junco danbyi*, Coues (gift); W. B. Judson, Highland Park, California, type of new Humming-bird (gift); Mr. William Palmer, U. S. National Museum, 1 specimen of *Oceanodroma cryptoleucura* from Washington, District of Columbia; Mr. Joseph Grinnell, Pasadena, California, 9 specimens, including types of *Pipilo clementæ* Grinnell; also 12 specimens of Jays (gift); Science College, Tokyo, Japan, 2 specimens of Petrels (gift); Mr. Rollo H. Beck, Berryessa, California, 23 specimens (gift); 9 bird skins from the Hawaiian Islands (purchase); 7 specimens of Parrots (purchase); Eugene Coubeaux, Saskatchewan, Northwest Territory, Canada, 10 bird skins; Mr. R. C. McGregor, Palo Alto, California, 14 specimens (gift);

Mr. J. D. Figgins, Falls Church, Virginia, 2 specimens (including 1 Bachman's sparrow) from Maryland (gift); Prof. W. B. Hinton, Kissimmee, Florida, 1 specimen of White-winged Dove, from Florida (gift); Alexander Hintze, Helsingfors, Finland, 2 specimens of Lapp Owl (gift); Mr. George Ayers, Alexandria, Virginia, 1 specimen of Brunnich's Murre (gift); Mr. Lawrence Skow, Omaha, Nebraska, 1 specimen of Hybrid Teal (exchange); Mr. W. W. Price, Leland Stanford Junior University, 2 specimens of *Pinicola* from California (gift); Mr. Joseph Grinnell, Pasadena, California, 7 specimens of Californian birds (gift).

The Museum is indebted to the following individuals and institutions for material transmitted at the request of the curator for examination: Mr. Osbert Salvin, London, England; Mr. William Brewster, Cambridge, Massachusetts; the American Museum of Natural History, New York City; the Academy of Natural Sciences of Philadelphia, and the Boston Society of Natural History.

Considerable attention has been given to the exhibition series, and it is now in much better condition than for several years past, although a general rearrangement would greatly improve its appearance.

The following extract from the report of the curator indicates the present condition of the study series and the progress made in caring for the collections:

The condition of the study series is very satisfactory, except that portion contained in the storage bases in the west basement, which remains practicably inaccessible. A large portion of the collection contained in the bird gallery was radically rearranged, the classification followed being that of Dr. Stejneger. The contents of 52 quarter-unit cases were involved, and in order to give the specimens ample room and allow for moderate growth of the collections, 19 additional cases were required. The new arrangement is a systematic one, the previous one being geographical. The collection is divided into a North American, Neotropical, and Old World series. The bird gallery has now become so crowded that further case-room can not be had there; eleven of the cases are placed in double tiers. A half-unit "type" case with quarter-unit compartments was installed in the gallery, and the majority of types of small birds were removed from the general collection during the process of rearrangement and placed in this case. A large portion of the collection (over 5,000 specimens) made by Dr. E. A. Mearns was distributed in the general series at the same time.

About 35 cases in the bird gallery were labeled.

An additional room was placed at the disposal of the curator during the year, to be used both as an office and storeroom. Fourteen quarter-unit cases were placed in it, and the collections of pigeons, cuckoos, and part of the Coroidæ were thus provided for. Twelve new half-unit cases were installed in the west basement, and many large birds contained in the old Salvin cases were transferred to them temporarily, but the whole west basement collection will require readjustment when the remainder of the new cases are ready for use.

Since the death, in February, 1897, of Maj. Charles Bendire, honorary curator of the department of birds' eggs, the routine work of that office has been conducted by the curator and assistant curator of the department of birds.

A group of about 250 parrots and birds of British Guiana was prepared for the Tennessee Centennial Exposition at Nashville.

There have been no explorations directly under the auspices of the Museum through which material has been added to the collections of

this department. Many of the specimens referred to above, in the list of important accessions, were, however, collected by the individuals or institutions transmitting them.

A large quantity of material has been lent for study during the year, and a number of specialists have prosecuted investigations in the department, as will be seen by a reference to the chapters entitled "Material lent for investigation" and "The work of students and investigators at the Museum."

The Museum is indebted to Mr. H. C. Oberholser, of the Department of Agriculture, for the identification of certain specimens of owls, and for the arrangement of a small portion of the study series, and also to Dr. A. K. Fisher for special services.

The time of Mr. Ridgway has been devoted very largely to the preparation of his proposed work on the Birds of North and Middle America. Regarding the progress made he says:

Since June 30, 1896, there have been completed the synonymy, family diagnoses, and concomitant matter—except (in most cases) specific diagnoses, statement of geographic range, etc.—pertaining to 31 families, 261 genera, and 1,093 species, belonging to the proper field of the work, besides numerous extralimital genera and species brought into the analytical "keys" to facilitate identification.

With the exception of a part of the Fringillidæ the synonymy is now complete (except for final revision) for the entire avifauna of the geographical area bounded on the south by the Panama Railroad, together with the West Indies and the Galapagos Archipelago, embracing altogether about 3,000 species, nearly 750 genera, and 100 families. The portion of the work completed constitutes in some respects the most laborious part of the undertaking, having involved the collation and verification of many thousands of references.

The assistant curator, Mr. C. W. Richmond, was engaged at intervals from July 1 to September 1, 1896, in the determination of Dr. W. L. Abbott's collection from East Africa. This work is still unfinished, however, owing to the great amount of routine and miscellaneous work which has since occupied Mr. Richmond's time. The work of preparing a card catalogue of the described species of birds, with reference to the original descriptions, type localities, etc., has been continued.

Twenty-nine papers based directly or indirectly upon material belonging to the department have been published during the year. These papers are mentioned by title in the Bibliography (Appendix IV). They contain descriptions of a large number of new species and two new genera.

The plans of the curator for the further development of the department remain substantially the same as indicated in previous reports, and Mr. Ridgway states that the pressure of other work is so great that no decided advancement can be made along the lines indicated until an additional skilled assistant be employed.

The number of specimens received during the year was 4,947, involving the same number of catalogue entries. The total number of specimens in the collection is estimated at about 104,000.

DEPARTMENT OF BIRDS' EGGS.

Maj. Charles Bendire, honorary curator of this department, died on February 4, 1897. An account of his life and of his valuable services to the National Museum will be found under the head of "Necrology."

At the close of the fiscal year no one had been appointed to the position of curator. The routine work of the office has, however, been conducted in the department of birds.

The most important accessions of the year are as follows:

From Dr. W. L. Ralph, Utica, New York, 610 eggs and 51 nests were received. These were all from North America, and included many rarities, such as the eggs of the White-throated Swift (new to science), the Western Evening Grosbeak (new to science), the Buff-breasted Flycatcher, Grace's and Hermit Warblers, the Everglade Kite, etc.

Mr. Otto Widman, Old Orchard, Missouri, presented the nest and 3 eggs of Bachman's Warbler (new to science).

Forty-eight eggs and several nests from Lower Siam were presented by Dr. W. L. Abbott.

From Dr. J. C. Merrill, Surgeon-General's Office, Washington, District of Columbia, were received 49 eggs from Fort Sherman, Idaho.

Forty-three eggs, collected in Texas, were presented by Mr. H. P. Attwater, of San Antonio.

Twelve eggs of rare Petrels were received from Mr. A. W. Anthony, San Diego, California. Three of these were donated and the remainder purchased.

Special Bulletin No. 3 of the U. S. National Museum, constituting Volume II of Major Bendire's Life Histories of North American Birds, was published early in the fiscal year. This volume contains 518 pages and 7 colored plates. The titles of three other papers, based wholly or in part on material in this department, are given in the Bibliography (Appendix IV).

The number of eggs received during the year was 838, and of nests, 102. There were 300 entries made in the catalogue.

DEPARTMENT OF REPTILES AND BATRACHIANS.

The curator of this department, Dr. Leonhard Stejneger, was absent during the first half of the fiscal year on duty connected with the investigation of the fur-seal rookeries, and after his return to Washington he was engaged for some time in the preparation of a report upon the results of his observations. In May he was detailed by the President of the United States for similar duty during the summer of 1897. For these reasons the work of the department of reptiles and batrachians has been greatly interfered with. There has, however, been an increase of 50 per cent in the number of permanent accessions, the total for the year having been 66. The most important additions are as follows:

A collection of reptiles and batrachians from Liberia, obtained by

Prof. O. F. Cook, of the U. S. National Museum; a number of reptiles, chiefly from Australia, received in exchange from the Australian Museum, Sydney, New South Wales; two lots of material collected by Dr. W. L. Abbott in Lower Siam; a collection of reptiles and batrachians from Madagascar, obtained by purchase; a series from Yesso Island, Japan, presented by S. Nozawa, Sapporo, Japan; a number of lizards from Hawaii, transmitted by Mr. H. W. Henshaw, and a collection of the same character from Mr. Valdemar Knudsen. Doctor Stejneger collected reptiles and batrachians in Japan and the Hawaiian Islands, and material from Japan was also received from the Science College Museum, Tokio.

Mr. William Palmer, Mr. D. W. Prentiss, jr., and Mr. Paul Bartsch collected material in the Dismal Swamp, Virginia.

The collections were examined systematically on two occasions, and the alcohol replenished and strengthened as required.

A paper by Doctor Stejneger on a new species of Guillemot from the Kurile Islands was published in the Auk of April, 1897.

The number of specimens received and entered during the year was 1,158, the total number now in the collection being placed at 36,777.

DEPARTMENT OF FISHES.

Dr. Tarleton H. Bean continues to act as honorary curator of this department, although Mr. Barton A. Bean, the assistant curator, has practically had charge of the department during the year.

During the year there were 30 accessions to the collection, four of which were "temporary." The total number of accessions last year was 22. So far as scientific value is concerned, the material received compares favorably with that acquired during the preceding year. A series of fishes obtained by the steamer *Albatross* in the vicinity of the Hawaiian Islands, off the coast of Lower California, and in the vicinity of the Galapagos Islands, was received from the U. S. Fish Commission. The commission also transmitted a collection of types and cotypes of 41 species of fishes from the west coast of North America, and a series of specimens from the Colorado and Columbia rivers, including several types. Prof. Seth E. Meek, of the Field Columbian Museum, presented a fine series of fishes collected by himself in the Bay of Naples. Material was received in exchange from the Australian Museum, Sydney, New South Wales, and from the Museum of Natural History, Lyons, France. A series of fishes from the vicinity of Yesso Island was presented by Mr. S. Nozawa, by whom they were collected. An interesting collection obtained in 1892 and 1894 in Mexico by Messrs. Nelson and Goldman, of the U. S. Department of Agriculture, was turned over to the Museum. Prof. O. F. Cook collected a few fishes during his recent trip to Liberia.

The study series has been increased during the year by the addition

of numerous type specimens and other desiderata. A large portion of the series stored in the west basement has been relabeled and condensed, with a view to making it more accessible. The collections on exhibition are referred to in the chapter entitled "Development and arrangement of the exhibition series."

All of the specimens received during the year have been entered on the catalogue books, and most of them are labeled and installed. The entire collection has been examined from time to time, to insure the preservation of the specimens. In February and March, 1897, an exhibit consisting of deep-sea forms and a series of casts of American fishes was prepared for the Tennessee Centennial and International Exposition at Nashville.

Small sets of American fishes were distributed to the following foreign institutions: Museo Civico di Storia Naturale, Genoa, Italy; Zoologisches Institut, Kiel, Germany; The Australian Museum, Sydney, New South Wales; The Natural History Museum, Academy of Sciences, Stockholm, Sweden.

The preparation of a report upon the fishes collected by the U. S. Fish Commission steamer *Albatross* in South American waters in 1887–88 has been continued by the honorary curator. A report has been prepared by the assistant curator upon several new fishes from Bering Sea, and the manuscript and drawings are now ready for the printer. The fishes collected by Messrs. Nelson and Goldman in Mexico have also been reported upon by Mr. Barton A. Bean.

Material has been sent to a number of persons for study, and several specialists have prosecuted investigations in the department. A reference to these transactions will be found in another place.

Dr. Theodore Gill, associate in zoology, has, as usual, rendered valuable assistance during the year. Drs. David S. Jordan, C. H. Gilbert, S. E. Meek, and W. C. Kendall have aided in the examination of doubtful species.

Two ichthyological works of special importance have been published during the year—Special Bulletin No. 2 of the Museum, entitled Oceanic Ichthyology, by the late Dr. G. Brown Goode and Dr. Tarleton H. Bean, and part 1 of Bulletin No. 47, entitled The Fishes of North and Middle America, by Messrs. Jordan and Evermann. Thirteen other papers based upon Museum material have been published, the titles of which will be found in the Bibliography (Appendix IV.)

New cases will be constructed for that portion of the collection which was removed from the room above the office of the department. Electric lights have recently been furnished in the basement.

A portion of the study series has been stored in the exhibition hall for some time past, this condition of things being necessary on account of lack of space. Additional cases should be erected in the basement for the accommodation of these specimens, the exhibition space thus provided being used for the installation of a collection which will be of popular interest.

In order to provide additional material to take the place of the alcoholic specimens, which will inevitably deteriorate, it will be necessary to collect, from time to time, the fishes of our coasts, even the common forms.

There were 2,110 specimens received during the year, the total number of specimens in the collection being estimated at 150,000. These figures are the same as those given in the last report, since the material distributed, in connection with a small amount of useless duplicate material which has been discarded, is about equal to the receipts for the year. The last catalogue entry on June 30, 1896, was 47687, and on June 30, 1897, 48471.

DEPARTMENT OF MOLLUSKS.

Dr. William H. Dall, honorary curator, states that there were 149 accessions to the collection of mollusks during the year, as compared with 118 for the preceding year. It is estimated that these accessions embrace more than 10,000 specimens, which is three times the number included in the accessions for 1895–96. While many of the accessions were not large or important, on the whole an unusual number of desirable species were received and, as a result, many gaps in the reserve series have been filled.

The curator calls special attention to the following contributions:

The most important accessions are those due to the generosity of Rev. L. T. Chamberlain, of New York City, who, as in past years, has contributed by the purchase of desirable material, especially Unionidæ. Much-needed publications bearing on the same subject have also been secured. The most important single lot of specimens comprised 232 species and over 700 specimens from the well-known Sallé collection, recently sold in Paris.

Next in importance is a series of 200 species and 315 specimens purchased to complete the series exhibited at Nashville. All of these will be added to the reserve series and will supply many deficiencies.

Thirdly, there should be mentioned a quantity of material received from the U. S. Fish Commission, comprising about 5,700 specimens. Among these are many desirable additions to our collections of North Pacific mollusks.

A collection containing about 400 species, largely from the Island of Cuba and adjacent regions, was purchased, adding a number of desiderata to the Museum series.

Among the smaller lots which are worthy of special mention are the following:

From Dr. W. L. Abbott was received a small but interesting series of shells from the Malay Peninsula. All of the material was new to the collection, and it included a number of fine specimens, among them a new species of *Nanina*.

Mr. J. S. Arnheim, of San Francisco, presented 50 or 60 miscellaneous species, most of which were desiderata.

Rev. E. H. Ashmun, Albuquerque, New Mexico, presented several small lots of interesting land shells from New Mexico and Arizona. These included a few new species.

From the Australian Museum, Sydney, New South Wales, 29 species of most desirable Australian land shells were received in exchange.

Mrs. T. S. Oldroyd, Los Angeles, California, has continued her researches into the fauna of San Pedro and has presented a number of species not before represented in the collection from that locality. Some of these were undescribed.

Dr. W. H. Rush, U. S. N., sent in exchange a number of typical specimens of interesting shells from the Parana River and adjacent parts of South America.

The U. S. Department of Agriculture presented a number of interesting Mexican species collected by Mr. E. W. Nelson. Several of these were new and most of the others were not previously represented in the Museum series.

Dr. De Witt Webb, St. Augustine, Florida, presented negatives of photographs of a sea monster stranded near that place, named *Octopus giganteus* by Professor Verrill. Portions of the remains, preserved in formalin, were also transmitted.

Col. L. Worthington Wilmer gave a miscellaneous lot of shells from various localities, some of which were very acceptable.

Mr. Berlin H. Wright, Penn Yan, New York, contributed a large number of interesting Naiades, all of which filled gaps in the geographical series and several of which were author's cotypes of new species.

In the chapter entitled "Development and arrangement of the exhibition series" will be found a statement relating to the exhibition series in this department. A series of mounted specimens, illustrating the families of mollusks, was sent to Nashville for exhibition at the Tennessee Centennial Exposition. The study or reserve series has been considerably increased during the year, and the whole collection is in condition for reference by means of a card catalogue of the genera. The material received from Professor Verrill is now all labeled and listed, but it will not be incorporated with the regular study series until the remainder of the specimens have been received from him. The work of registering the Jeffreys collection has progressed, although slowly, on account of the extreme care which it is necessary to exercise in handling the material. The reserve collection of alcoholics, except the most recent accessions, is now catalogued on cards, more than 2,000 of the latter having been filled out during the year. The collection of duplicates is also fully catalogued and in perfect order. The number of species represented is 4,174. The collection of minute Helicidæ—*Pupa*, *Vertigo*, *Pisidium*, etc.—has been worked over and named by Dr. V. Sterki, and may now be regarded as in complete order for reference.

The honorary curator makes the following statement regarding the scientific work accomplished by members of the staff and by others not connected with the department:

The report on the land shells collected by the Mexican Boundary Commission has been printed. The discussion of the insular land faunæ illustrated by the collections at the Galapagos Islands, by Dr. G. Baur and others, is likewise printed.

The descriptions of the Antillean Tertiary fossils prepared by the curator from the collections of the National Museum, including a revision of the manuscript submitted by Mr. R. J. L. Guppy, of Trinidad, West Indies, have also been published.

Work has been continued by Mr. Chas. T. Simpson on his proposed monograph of the Naiades, and fair progress has been made. The curator has continued to devote considerable time to the Neocene fauna of Florida. The Pelecypods, up to and including the Pectinidæ, are practically finished. This work involved complete revision of the reserve series belonging to the Museum, as far as the work has gone.

Mr. H. A. Pilsbry, of the Academy of Natural Sciences of Philadelphia, has been studying the collection of Scaphopods, which is one of the largest in the world, in connection with his monograph of that group, now in preparation. He has also utilized the collection of the genus *Bulimus* for the same purpose.

Dr. E. L. Mark, of Harvard University, has studied the collection of microscopic slides illustrating the anatomy of the rare forms of Pelecypoda, and Mr. Berlin H. Wright has utilized the collection of Naiades in connection with his studies of that group.

Mr. T. Wayland Vaughan has had the use of the entire collection of Eocene corals in connection with his researches.

Prof. G. D. Harris, of Cornell University, utilized the collection in connection with his work on the lower Eocene faunæ.

A number of minor investigations of particular groups or species have been made by members of the staff, and also by visitors.

Miss Jennie A. Letson, of Buffalo, a student of the Academy of Natural Sciences of Philadelphia, devoted several weeks to a general study of the Mollusca. In return for the privileges afforded she rendered considerable assistance during a portion of the time in the regular work of the department.

Mr. Charles Schuchert, while making explorations in southern Mississippi, obtained and transmitted to the Museum some interesting specimens of mollusks.

Mr. William Palmer, of the National Museum, sent in a small number of specimens.

Dr. Dall mentions the names of 30 persons who have made collections with a view to working out local faunæ, and who have in most cases contributed types of new species to the Museum, in return for the work performed by the department in examination and identification. In this connection it is stated that during the year applications for information of various kinds were received from 164 persons, and that compliance with these requests involved the identification of 3,734 species of mollusks, besides the preparation of a large number of letters.

Material for examination has been lent to Mr. H. A. Pilsbry, of the Academy of Natural Sciences of Philadelphia, and Mr. Berlin H. Wright, of Penn Yan, New York.

Twenty-three papers based upon Museum material have been published during the year by members of the staff and other collaborators. The titles of these papers will be found in the Bibliography (Appendix IV.)

At the present rate of progress several years will be required to complete the work of cataloguing, labeling, and arranging for reference the material now on hand. The Jeffreys collection and the material in Professor Verrill's hands must be finally administered upon, and the duplicates entirely eliminated from the reserves.

The total number of specimens in the department of mollusks, exclusive of fossils, is estimated to be 632,300. The fossils number about 67,000. More than 2,800 entries have been made in the catalogues of recent shells. The total registrations of all kinds, including entries made in the catalogues reserved for fossils, exceeded 18,000, an increase of about 50 per cent over the registrations for the preceding year.

DEPARTMENT OF INSECTS.

The honorary curator of this department, Dr. L. O. Howard, states that while there has been a decrease in the number of accessions, or "lots," of material received, there has been a marked increase in the number of specimens and species represented in these accessions. The material is also of greater scientific value. The most important accessions are here mentioned:

From Dr. W. L. Abbott, about 4,600 specimens from Trong, Lower Siam (gift); from Rev. D. W. Snyder, 1,410 specimens of insects from Luebo, Congo (gift); from D. W. Coquillett, Department of Agriculture, 860 specimens of Tachinidæ, including 81 type specimens (gift); from H. G. Hubbard and E. A. Schwarz, Department of Agriculture, 69 species of Coleoptera, new to the collection (gift); from the Department of Agriculture, about 600 specimens of Homoptera, Micro-hymenoptera, and Coccinellidæ from China, Japan, and Australia, collected by Mr. Albert Koebele (gift); from Prof. T. D. A Cockerell, Las Cruces, New Mexico, types of Hymenoptera from Mexico and New Mexico; from Prof. H. Osborn, Ames, Iowa, types of 20 species of Homoptera (gift); from H. G. Hubbard, Department of Agriculture, a choice collection of Hymenoptera from the arid region of Arizona (gift); from Prof. O. F. Cook, a collection of European Myriapods (gift); from H. G. Hubbard, Department of Agriculture, 118 species of Coleoptera from the West Indies (gift); from the Department of Agriculture, 168 specimens of Acridiidæ collected in Mexico by C. H. Tyler Townsend (gift); from J. G. Foetterle, Petropolis, Brazil, 115 specimens of Lepidoptera from his locality (gift); from Dr. A. Dugès, Guanajuato, Mexico, a new Cynipid and a new Curculionid from Guanajuato, Mexico (gift); from Prof. J. B. Smith, New Brunswick, New Jersey, 7 types of *Acronyctas* (gift); from the Musée d'Histoire Naturelle, Geneva, Switzerland, a collection of Orthoptera (exchange).

The fragmentary exhibition series, owing to the lack of a more suitable place, has been arranged in the hallway leading to the offices of the department of insects. On account of the unfavorable conditions under which the specimens are exhibited, many of them need remounting, and in some cases new and fresh material should be substituted for the old. The study, or systematic, series is in good condition, although some additional labels should be supplied.

The honorary curator states that an effort will be made to arrange and determine all the exotic material during the coming winter.

A considerable amount of scientific work has been accomplished during the year, as will be seen from the following paragraphs quoted from the report of Dr. Howard:

Mr. D. W. Coquillett has been engaged in monographing the flies belonging to the family Tachinidæ, a group of parasitic flies of great economic importance. The work is based largely upon Museum material, and has just been completed. It will be published shortly as a special bulletin of the Department of Agriculture. Mr. Coquillett has also nearly completed a revision of the Simulidæ in our collection.

Mr. E. A. Schwarz is monographing the North American Psyllidæ. The monograph will be based entirely on the extensive collection of these insects in the National Museum.

Mr. W. H. Ashmead is monographing the Hymenopterous family Braconidæ, and hopes to complete the work this fall. During his studies he has identified and rearranged the collection of these insects in the Museum. He has also studied the

Ichneumonidæ and some groups of the Micro-hymenoptera, particularly the families Cynipidæ and Chalcididæ, besides doing much work in naming and rearranging the Aculeate Hymenoptera, and in labeling and cataloguing the type specimens in all orders.

Prof. Carl F. Baker of Fort Collins, Colorado, is monographing the families Jassidæ and Cercopidæ, and Prof. H. E. Summers is doing similar work with the Hydrobatidæ.

The explorations of Dr. W. L. Abbott in the Malay Peninsula, of Mr. Albert Koebele in China, Japan, and Australia, and of Rev. D. W. Snyder in the Congo region, West Africa, have resulted in the addition to the collections of many new and rare forms. Reference has already been made to the material obtained. During the summer of 1896 Mr. Rolla P. Currie made collections in North Dakota, Minnesota, Montana, and Wyoming. Many of the specimens obtained probably represent well-known species, although a few are rare or new, while others will help to fill up gaps in the systematic collection. In November, Mr. Currie accompanied Prof. O. F. Cook to Liberia, where he made quite extensive collections of Arthropoda. The material collected had not, however, reached Washington at the close of the fiscal year.

In the chapter treating of "Material lent for investigation" a reference will be found to the specimens sent out from this department for study.

Thirty-seven papers based upon material in the Museum have been published during the year by members of the staff of this department, and five others by persons not officially connected with the Museum. The titles of these papers are given in the Bibliography (Appendix IV).

There were 13,217 specimens received during the year, and 239 entries were made in the catalogue. The total number of specimens now in the collection, including some material which has been received on deposit, is estimated at 643,000.

DEPARTMENT OF MARINE INVERTEBRATES.

Mr. Richard Rathbun, who was recently appointed Assistant Secretary of the Smithsonian Institution, continues to act as honorary curator of this department. He states that during the year the entire collection has been overhauled, the jars supplied with new stoppers, when necessary, and the alcohol replenished. Catalogue cards have been made for all the specimens entered on the books. Eight collections of marine invertebrates have been sent to educational institutions, and a considerable number of special collections have been prepared and distributed, most of the latter, however, having been sent in exchange.

An exhibit, consisting of five cases of echinoderms, corals, and sponges, was prepared for the Tennessee Centennial Exposition, at Nashville. The echinoderms were arranged in systematic order, the corals and sponges being grouped in an attractive manner. A fine series of commercial sponges, crustaceans, and corals was lent to the U. S. Fish Commission for its exhibit at Nashville.

The work of separating the material collected by the Fish Commis-

sion and stored at the museum of Yale University has been carried on during the year under the direction of Professor Verrill, although no specimens have been received at the National Museum.

The condition of the exhibition and study series is practically the same as indicated in the Report for last year.

There was an increase of 13 in the number of accessions, the total having been 82. The material received from the U. S. Fish Commission is not nearly so valuable as that received during the preceding year. On the other hand, the value of the accessions from outside sources has greatly exceeded that of the accessions for 1895–96.

The material of greatest importance is here mentioned:

One hundred and twenty-four microscopic slides of Adriatic sponges (purchase); from the State University of Iowa, through Prof. C. C. Nutting, 14 species of crabs and 52 microscopic slides of Plumularian hydroids, collected chiefly by the biological expedition made by the University to the Bahamas and Florida Keys in 1893 (exchange); from the Museum of Natural History, Paris, through Prof. E. L. Bouvier, 72 species of crabs (exchange); from the Royal Zoological Museum, Turin, Italy, through Mr. Joseph Nobili, 31 species of Crustacea (exchange); from the Royal Museum of Natural History, Berlin, Germany, 32 species of crabs (exchange); from the Zoological Museum, Copenhagen, through Dr. F. Meinert, 30 species of crabs (exchange); from the University of Stockholm, through Prof. Wilhelm Leche, 24 species of European Crustacea (exchange); from Dr. R. Koehler, Lyons, France, 21 species of invertebrates dredged in the Gulf of Gascogne (exchange); from Prof. D'Arcy W. Thompson, Dundee, Scotland, 16 specimens of Crustacea, chiefly from Davis Straits (exchange); from the Museum of Natural History, Geneva, Switzerland, through Dr. N. d'Adelung, 12 species of Crustacea (exchange); from the British Museum of Natural History, London, England, 9 species of crabs (exchange).

Prof. W. P. Hay, Washington, D. C., transmitted 25 species of Crayfishes, in exchange. Many of these were type specimens. Six species of Crayfishes, described by Dr. Walter Faxon, were sent, in exchange, by the Museum of Comparative Zoology, Cambridge, Massachusetts. From Cornell University, through Prof. J. H. Comstock, were received 19 species of invertebrates collected by the Cornell expedition to Greenland in 1896. Eight species of Crustacea and 5 Japanese sponges were purchased.

Other accessions were as follows: From Mr. F. S. Conant, Johns Hopkins University, Baltimore, 29 species of crabs collected in Kingston Harbor, Jamaica (gift); from Dr. E. A. Andrews, Johns Hopkins University, Baltimore, 17 species of crabs collected in the Bahamas (gift); from the U. S. Fish Commission, material obtained in connection with oyster investigations in Long Island Sound in 1890 and 1892 (gift); from the Fur-Seal Commission, Dr. David S. Jordan, president, invertebrates collected in Japan and the Bering Sea (gift); from Dr. Leonhard Stejneger, U. S. National Museum, Crustacea and worms from the Sandwich Islands (gift); from Dr. W. L. Abbott, crabs, lobsters, and shrimps collected in Siam (gift); from Mr. A. W. Anthony, San Diego, California, Crustacea collected on the west coast of Lower California (purchase); from H. Farquhar, department of lands and survey, Wellington, New Zealand, 5 species of echinoderms (exchange); from Mr. E. B. Carter, St. Augustine, Florida, 2 pieces of wood eaten by Isopods, also numerous specimens of Isopods from St. Johns River, Florida (gift); from T. D. A. Cockerell, Mesilla, New Mexico, 2 species of Isopods, one of which was undescribed, from the vicinity of Socorro, New Mexico (gift); from J. O. Snyder, Stanford University, California, crustaceans, worms, and hydroids collected on the coast of southern California (gift); from H. N. Lowe, Pasadena, California, crustaceans and echinoderms collected in San Pedro Bay, California (gift).

Special investigations have been prosecuted by members of the staff of this department, as follows:

Mr. Benedict, assistant curator, has made a study of the Isopoda, especially those collected by the steamer *Albatross*. He has determined the bulk of the unnamed specimens, and has nearly completed a report upon the same, for which a number of drawings have been made.

Miss Rathbun, second assistant curator, has continued her studies of the Brachyura, and has completed a revision of the nomenclature. Special studies of the Palicidæ, the fresh-water crabs, and the genera *Callinectes*, *Sesarma*, and *Ethusa*, have also been carried on.

Miss Rathbun was on detached service for four months for the purpose of visiting the museums of London, Copenhagen, Kiel, Berlin, Geneva, and Paris. During her travels many type specimens of decapod crustacea were examined, and about 140 photographs made for future comparison and study. Exchanges were arranged with the museums visited, and one series has already been received from each. The number of species represented in these collections is 176, and the number of specimens, 312. Nearly all the species are new to the collection, and 28 type specimens are included.

Some of the museums visited kindly lent specimens of crabs to the U. S. National Museum for study.

Those who were especially instrumental in bringing about these results were Sir William H. Flower, Mr. Charles E. Fagan, and Prof. F. Jeffrey Bell, of the British Museum of Natural History; Dr. F. Meinert, of the Zoological Museum, Copenhagen; Dr. K. Brandt, director of the Zoological Institute, Kiel, Germany; Dr. K. Möbius, director of the Royal Zoological Museum, Berlin; Dr. F. Hilgendorf, also of the Berlin Museum; Dr. N. d'Adelung and Prof. H. de Saussure, of the Museum of Natural History, Geneva, Switzerland; and Prof. A. Milne-Edwards and Prof. E. L. Bouvier, of the Museum of Natural History, Paris.

Material for study and examination has been sent to five specialists during the year, and others have prosecuted investigations in the department. Further reference to these matters will be found in another part of this Report.

Assistance has been rendered in various ways by persons not connected with the Museum, as may be seen from the following paragraphs taken from the report of the honorary curator:

Dr. Walter Faxon submitted for publication a report on the crayfishes added to our collection during recent years, at the same time returning the specimens upon which the report is based, and adding others from the collections of the Museum of Comparative Zoology at Cambridge.

Prof. C. C. Nutting, who is monographing the hydroids, including the large collection belonging to the Museum, has completed and transmitted for publication that part treating of the Plumularidæ.

Dr. A. Zumbrach was a volunteer assistant in the department from October to June, rendering valuable service during that time in translating from the German.

Mr. W. P. Hay, professor of zoology at the Central High School, who has assisted the department in various ways, contributed his entire collection of crayfishes, including many types.

Mr. F. S. Morton, Portland, Maine, has mounted and named a number of specimens of Foraminifera for the Museum.

Miss Harriet Richardson has been a volunteer assistant in the department since September, 1896, and has aided in the identification of the Isopoda, especially the Sphæromidæ. Descriptions and figures of several species have already been published

Fifteen papers based upon Museum material have been published during the year. The titles of these are given in the Bibliography (Appendix IV).

It is proposed to rearrange the exhibits in the west hall of the Smithsonian Building. In carrying out this rearrangement more attention will be given to systematic order and a better representation of the genera. New cases will be provided. Forms which can not be represented properly by specimens will be shown by casts or diagrams.

Nearly 2,400 specimens were received during the year, the total number in the collection being estimated at about 529,000. Eight hundred and twenty-five entries were made in the catalogues, as follows: Crustaceans, 586; worms, 20; bryozoans and ascidians, 10; echinoderms and coelenterates, 203; sponges and protozoans, 6.

HELMINTHOLOGICAL COLLECTION.

Dr. C. W. Stiles, custodian, reports that four collections have been added to the Museum series during the year, namely, the collection of the Bureau of Animal Industry, Department of Agriculture, and the private collections of Drs. Leidy, Stiles, and Hassall. These have all been received on deposit, with the understanding, however, that the duplicate material is subject to exchange with other museums. The helminthological collection of the U. S. National Museum is now, with one or two exceptions, the largest in the world.

In addition to the material above mentioned, a collection of parasites of seals, obtained by the Fur-Seal Investigation Commission in Alaska, was received from the Bureau of Animal Industry.

Owing to limited space it is impossible to satisfactorily arrange the study series. There is no exhibition series. No comprehensive plans for the further development of the section can be carried out until more room is provided.

Doctor Stiles has completed an extensive revision of the adult cestodes of hares and rabbits. This paper was published in the Proceedings of the National Museum. He has also published, as a bulletin of the Department of Agriculture, a paper on the tapeworms of poultry. Doctors Stiles and Hassall have prepared a paper on the parasites collected in Alaska by the Fur-Seal Investigation Commission. An extensive report upon certain parasites of meat inspection, by Doctor Stiles, is also ready for the press.

The catalogue entries for the year cover nearly 3,000 numbers.

DEPARTMENT OF COMPARATIVE ANATOMY.

Mr. F. A. Lucas, curator of this department, was absent from the Museum from June 18 to October 15, 1896, having been detailed to accompany the party visiting the Pribilof Islands for the purpose of aiding in ascertaining the condition of the fur-seal herds. On June 5, 1897, he again left for the north on a similar mission..

The number of accessions to the collection has been small, although such material as has been received is of considerable scientific value. The study series is overcrowded, and many valuable specimens are in storage. It is possible to employ only a very small force in the preparation of material, and facilities for the work are also limited. For these reasons no effort has been made to accumulate specimens which could not be cared for, and only particularly desirable material has been accepted.

A skeleton of an Australian native and a skeleton of a Gangetic crocodile were purchased for the exhibit at the Tennessee Centennial Exposition. A number of skeletons of mammals, birds, and reptiles from Lower Siam, collected by Dr. W. L. Abbott, were transmitted to the Museum. The specimens are all in excellent condition and include many species not before represented in the collection.

The exhibition series of the department is in especially good condition. The study series, although overcrowded, is also well cared for. The cataloguing of specimens has been kept up, but owing to the absence of the curator and the rearrangement of the cases and specimens in the exhibition hall, necessitated by the laying of a new floor, no great amount of progress has been made in developing the collections.

In speaking of special investigations, Mr. Lucas says:

In connection with his report on the fur-seal the curator has devoted considerable attention to the question of dentition and to other anatomical points, as well as to the food and breeding habits and diseases of the fur-seal. The food was determined almost entirely from osteological material, and in this connection one new genus of fishes has been described. The description has not yet, however, been published. The curator has also examined and identified the bones collected by Doctor Fewkes at the ancient pueblo of Homolobi, and in this connection published a note on an ancient Indian dog. The study of species of fossil bison of North America has been continued, as well as the study of a new species of fossil shark from Iowa.

The exhibition series has been studied at various times by students from the medical colleges and the high schools. Students and teachers have been allowed the use of the dissecting models whenever possible. A new genus and species of fossil Skate were described by Dr. C. R. Eastman, of the Museum of Comparative Zoology, Cambridge, from material sent to him.

The number of specimens received during the year was 110, representing the same number of catalogue entries. The total number of specimens now in the collection is 15,395. The last numbers in the

various catalogues at the end of June, 1896, and June, 1897, are shown in the appended table.

	1896.	1897.
Mammals	49436	49469
Birds	19446	19480
Reptiles and amphibians	29396	29410
Fishes	26185	26194
Anatomical models	5520	5527

DEPARTMENT OF PALEONTOLOGY.

The scientific value of the collections received during the past year in this department, of which the Acting Assistant Secretary is the honorary curator, has exceeded that of the two preceding fiscal years.

The collection of greatest value was made by Mr. Charles Schuchert, assistant curator, in southern Alabama. As a result the National Museum now has nearly complete skeletons of *Zeuglodon* and *Dorudon*, besides much suplementary material. Mr. Schuchert also made a small but interesting collection of Ordovician and Devonian fossils in Tennessee.

The U. S. Geological Survey transferred to the Museum seven lots of invertebrate fossils, all of which are of considerable value.

Mr. R. D. Lacoe, Pittston, Pennsylvania, added to the Lacoe Collection 208 specimens of Tertiary fossil plants, many of them being types.

Mr. Walter Hough, assistant curator in the department of ethnology, presented his private collection of Carboniferous fossil plants and invertebrates.

Col. Charles Coote Grant, Hamilton, Ontario, donated two interesting lots of Silurian graptolites from his locality.

Mr. W. S. Gresley, Erie, Pennsylvania, presented a number of specimens of Lake Superior iron ores, containing probable fossil imprints. If these are actually the imprints of animals, they are the oldest known fossils.

Dr. Charles E. Beecher, New Haven, Connecticut, presented a small but valuable collection of Devonian phyllopod crustacea, and two models showing the ventral anatomy of trilobites.

Dr. Wheelton Hind, Stoke-upon-Trent, England, sent an interesting collection of Carboniferous mollusca in exchange.

Prof. E. H. Barbour, of the University of Nebraska, deposited a collection of the problematic fossils known as *Dæmonelix*, which was afterwards purchased.

The University of Wyoming, through Prof. Wilbur C. Knight, sent an interesting collection of Mesozoic invertebrates from Wyoming, in exchange.

The type specimens of *Lepidoxylon anomalum* and *Megaphytum goldenbergii* were received in exchange from Dr. J. H. Britts, Clinton, Missouri.

The Manchester Museum, Owens College, Manchester, England, presented fifty-four species of fossils from the Lancashire coal measures.

A great deal of time has been devoted to the exhibition series of fossil vertebrates and fossil plants, but the collections are still in a condition far from satisfactory. When the new gallery in the southeast court is completed, the former series will be considerably enlarged. The Marsh collection of vertebrates should be labeled and the entire invertebrate exhibition series mounted upon tiles. All of the fossil Medusæ illustrated by the Director of the U. S. Geological Survey in a work to be published by the Survey, will be placed upon exhibition. Two synoptic collections illustrating the genera, families, and orders of the Crinoids and Trilobites have been arranged and mounted on tiles for the Tennessee Centennial Exposition. About five months have been given to the preparation of the *Zeuglodon* material collected by Mr. Schuchert, and a nearly complete skeleton of this cetacean will soon be placed upon exhibition.

Considerable progress has been made with the study collections in the various sections of this department under the charge of Messrs. W. H. Dall, Lester F. Ward, T. W. Stanton, F. H. Knowlton, David White, and Charles Schuchert. The material gathered annually by these gentlemen is, however, accumulating more rapidly than they are able to study and finally dispose of.

The assistant curator has been able to give very little time to original research, owing to pressure of other work. He has, however, as opportunity permitted, continued his studies of the North American fossil starfishes. He has also prepared reports on several collections of fossils submitted to him by the Director of the U. S. Geological Survey. His work entitled Synopsis of American Fossil Brachiopoda, including Bibliography and Synonymy, has been completed, and is in type. It will appear as Bulletin No. 87 of the U. S. Geological Survey.

A number of papers have been published during the year by members of the staff of this department. The titles of these appear in the Bibliography (Appendix IV).

The assistant curator devoted a portion of the month of May, 1897, to collecting invertebrates from the Devonian strata of western Tennessee. His explorations in Alabama have already been referred to. From the Fewkes expedition of 1896, through Mr. Walter Hough, an interesting collection of Mesozoic invertebrate fossils was received. A large quantity of material collected by the paleontologists of the U. S. Geological Survey has been deposited in the Museum, but has not yet been formally transferred.

A number of specimens have been lent to Prof. Alpheus Hyatt, of Cambridge, Massachusetts, for use in the preparation of a synopsis of the class Cephalopoda. Professor Hyatt also spent a short time at the Museum in April, 1897, studying the ammonites.

Prof. J. F. Whiteaves, of the Geological Survey of Canada, identified

the Museum series of Ordovician fossils from the Red River of the North, and Prof. Charles E. Beecher, of Yale University, assisted in the arrangement of the synoptic collection of trilobites.

Collections of fossils, made either directly by the National Museum or through its influence, are arriving faster than the staff of the department can properly transfer them to the exhibition or study series. Material transmitted from the U. S. Geological Survey is also rapidly accumulating. Although this material has served the purpose for which it was collected by the Survey, it is not in condition for final disposition in the study or exhibition series. The services of a preparator are required, and the specimens must be finally identified and registered. Owing to lack of assistance and insufficient drawer-space, these collections have been accumulating for some time past, and there are now in storage 880 boxes of practically unworked material.

The most important gap in the paleontological collections of the Museum is in the vertebrate series. The assistant curator has, during the past three years, devoted many months to the work of gathering and preparing material of three skeletons of the large cetacean, *Zeuglodon cetoides*. More than 225 boxes of vertebrate material are in storage awaiting preparation. In addition to this the U. S. Geological Survey, through Prof. O. C. Marsh, of New Haven, desires to gradually turn over to the Museum the vast collections of vertebrate material which have been accumulating during the past ten or twelve years. Upon the gallery now being constructed in the southeast court will be placed the exhibition series of fossil plants which at present occupies the wall-cases along two sides of the ground floor in that court.

The total number of specimens received during the year is estimated at 5,300. The number of catalogue entries is shown in the following table:

Collection.	Number of entries.
Paleozoic invertebrates	719
Mesozoic invertebrates	11
Cenozoic invertebrates	13,427
Vertebrates	150
Fossil plants	208
Fossil plants (Lacoe Collection)	208
Total	14,723

DEPARTMENT OF BOTANY (NATIONAL HERBARIUM).

Mr. F. V. Coville, honorary curator of this department, states that there were 370 accessions during the year, an increase of 131 over the previous year. The material received is also of greater scientific value, the opportunities for advantageous exchange having been largely increased since the transfer of the Herbarium to the National Museum building.

The following accessions are of especial importance and have materially added to the value of the collection:

Nearly 900 South American plants from Dr. A. Engler, Berlin, Germany (exchange); 1,369 specimens from Mr. F. V. Coville (gift); 981 plants from the Sandwich Islands (purchase); 1,057 plants from Oregon (purchased by the Department of Agriculture); 1,000 specimens from Dr. W. H. Forwood, Washington, D. C. (gift); 625 Mexican plants purchased by the Department of Agriculture and about 1,500 Mexican plants purchased by the Museum; 424 specimens from Mississippi, collected by Mr. C. L. Pollard; 600 specimens from Connecticut, obtained by exchange with Dr. E. H. Eames, Bridgeport; 500 rare specimens from North and South Carolina, received in exchange from Biltmore Herbarium, Biltmore, North Carolina; 525 plants from Missouri (purchase); 600 California specimens (purchase); 735 specimens from India, sent in exchange by the Royal Botanic Gardens, Calcutta; 535 plants from Idaho (purchase); 1,267 specimens from Montana (purchase); 500 West Indian plants (purchase); 600 tropical plants from Dr. E. Warming, Copenhagen, Denmark (exchange); 300 South African plants from Dr. K. Schumann, Berlin, Germany (purchase); 382 Wyoming plants from Mr. A. Nelson, Laramie, Wyoming (exchange); 250 plants from Florida (purchase); 298 hepaticæ (purchase); 80 plants from the islands of California (purchase); 176 Australian plants from Mr. R. T. Baker, Sydney, Australia (exchange); 696 specimens from the Botanical Gardens of St. Petersburg, Russia (exchange); 226 African plants from Dr. Hans Schinz, Zurich, Germany (exchange).

There were also obtained by purchase 208 plants from Yucatan, 218 specimens from the Azores, 150 algæ, 50 specimens of *Salix*, and 209 Californian plants.

Additional material of special value was presented as follows: From Mrs. O. F. Cook, Washington, D. C., 335 foreign plants; from Mr. J. M. Macoun, Ottawa, Canada, 154 Arctic and Canadian specimens; from Mr. E. S. Steele, Washington, D. C., 110 grasses from the District of Columbia; from Mr. C. H. T. Townsend, 109 Texan plants, and from Prof. B. W. Evermann, 139 specimens from Idaho.

The collection is in excellent condition, although considerably crowded. Additional case-room is regarded as necessary if the present satisfactory development of the Herbarium is to continue. The species are so arranged as to be easily consulted, and many of the genera have been revised in the light of recent monographs. The old and worn-out genus covers have, in a large number of instances, been replaced by new ones. The progress made in other directions in caring for the collection is set forth in the following paragraphs:

The storage cases in the tower rooms have been thoroughly overhauled and all old collections, with few exceptions, have been mounted and prepared for distribution.

The Herbarium has been stamped almost up to the Leguminosæ, making a total number of about 18,000. The desirability of completing this count can not be too strongly emphasized, but it would require the exclusive services of a botanical assistant for the space of nearly a year. A similar statement might be made with reference to the transfer to the Herbarium of the old Museum collection now stored on the south balcony and the separation from it of the District herbarium.

The selection and labeling of type specimens has progressed in a very gratifying manner. There are now 1,344 types properly labeled and indexed, a large proportion of them consisting of species described within the last three years. In this connection the growth of the collection is evidenced by the fact that a total of 32,607 mounted sheets have been added to the Herbarium during the year. This work has been performed by two preparators, under the personal supervision of Mr. Pollard, the labeling of the types having been directed by Mr. Rose.

The development of the cryptogamic collection under Mr. Cook's charge has also been remarkable, but as Mr. Cook was here for the space of three months only, it is

impossible to give any definite statistics in relation thereto. It would be an advantage if this collection could be moved into one of the tower rooms, affording more light for microscopic study, but there is, unfortunately, no room on the balcony floor available for the preparators now at work in the tower.

In alluding to explorations, the honorary curator states that valuable collections have in several instances been obtained by employees of the Museum sent out to obtain materials in other groups. Mr. Charles Schuchert made collections during a trip to Alabama and Mississippi in October, 1896, and Dr. Leonhard Stejneger, during his trip to the islands of Bering Sea, obtained a number of specimens. Mr. Pollard, assistant curator, collected a quantity of material while on leave from the Museum. Full sets of the specimens collected in Mexico by Messrs. Nelson and Pringle have been purchased. These are of great value. The explorations of the field agents of the U. S. Department of Agriculture and the Fish Commission have also resulted in the acquisition of much important material.

Specimens for study and determination have been sent to fourteen specialists during the year, and a number of persons have made determinations and prosecuted investigations in the department. A more extended reference to these matters will be found in another place.

The following paragraphs, from the report of the honorary curator, relating to the scientific work of the members of the staff, are of interest:

Mr. Coville has been engaged, in connection with Mr. John B. Leiberg, field-agent of the Department of Agriculture, in preparing a synopsis of the botany of the northwest, based on the collections made in that region under the auspices of the Department and deposited in the National Herbarium. Mr. Coville has also continued work on the Pan-American Medicinal Flora, which is now in satisfactory condition, due in part to the cooperation of Drs. Havard and Rusby.

Mr. Rose has made determinations of the Polypetalæ in the Mexican collections of Messrs. Nelson, Pringle, and others, and has also begun the determination of Dr. Palmer's large collection from the vicinity of Durango, Mexico. He has published several reports on this work from time to time. In the fall of 1896 he was commissioned by the Museum to visit the herbaria of the Philadelphia Academy of Sciences, Columbia University in New York, and Harvard University for the purpose of studying the types of Mexican species. In addition, he has revised the genus *Chrysosplenium* in North America, and, in connection with Prof. John M. Coulter, the genus *Lilæopsis* (*Crantzia*).

Mr. Pollard has continued his work on the new edition of The Flora of the District of Columbia, which it is proposed to publish as a bulletin of the National Museum. In January Mr. Pollard was commissioned by the Museum to visit the herbarium of Columbia University in New York City, where he spent a week with Dr. N. L. Britton preparing the manuscript for the treatment of the family Cyperaceæ for the work above referred to. Mr. Pollard has also continued work on the Violaceæ and Gentianaceæ for the Systematic Botany of North America.

More than thirty papers, based upon Museum material, have been published during the year by members of the staff of the department and other specialists. The titles of these papers will be found in the Bibliography (Appendix IV).

The thanks of the Museum are due to Mrs. O. F. Cook, who spent

several hours each day for about three months in assisting Professor Cook in his work on the cryptogamic collections. Dr. B. L. Robinson, curator of the Gray Herbarium, Cambridge, Massachusetts, has been of great assistance to Mr. Rose in his work on the Mexican collections.

Mr. Coville recommends the establishment of an exhibition series in this department. The science of botany, except in certain economic aspects, has never been represented in the exhibition series of the Museum. He further states that it is very desirable that the cryptogamic portion of the collection should be developed. Some steps in this direction have recently been taken, but in order to carry out any comprehensive plan, more space is needed. The necessity of additional room for the study series has already been referred to.

The routine work of the department practically consumes the time of both of the assistant curators, leaving very little opportunity for the prosecution of special investigations. It is therefore recommended by the honorary curator that an assistant be employed, whose duty it shall be to look after some of the minor details.

In May, 1897, Mr. Rose left for Mazatlan, on the western coast of Mexico, for the purpose of collecting material illustrative of the botany and ethno-botany of the country extending from that point eastward across the lowlands and over the Sierra Madre Mountains. A plan of work has been outlined by the honorary curator and approved by the Acting Assistant Secretary. Through the courtesy of the Mexican minister at Washington, the cooperation of the governors of the States of Sinaloa and Durango, and other officials, has been secured.

The total number of specimens received during the year was about 40,000, of which 32 607 were added to the permanent collection. In the catalogue 374 entries were made.

DEPARTMENT OF MINERALS.

Prof. F. W. Clarke, chief chemist of the U. S. Geological Survey, remains in charge of this department as honorary curator, with Mr. Wirt Tassin as assistant curator. In January, Rev. Dr. L. T. Chamberlain, of New York City, was appointed custodian of the collection of gems and precious stones.

The relative scientific value of the accessions for the fiscal year ending June 30, 1897, and those of the preceding fiscal year is about the same. In the number of accessions, however, there has been an increase of more than 50 per cent during the year covered by this report.

From the Australian Museum, Sydney, New South Wales, a series of 63 minerals was obtained in exchange. Three specimens of gold pseudomorph after calverite, and one specimen of telluride, were presented by Mr. D. V. Donaldson, Colorado Springs, Colorado. Mr. F. W. Traphagen presented a specimen of corundum, variety sapphire, in matrix. There were deposited by the Smithsonian Institution three pieces of the meteorite which fell at Long Island, Phillips County, Kansas, an

emerald crystal in a geode of calcite from Muso mine, United States of Colombia, and two cut tourmalines from Paris, Maine, the latter being the gift of Rev. Dr. L. T. Chamberlain. A specimen of crystallized cinnabar, collected by J. E. Spurr, at Mercur, Utah, was transmitted by the U. S. Geological Survey. Mr. Wirt Tassin collected 241 specimens illustrating the mineralogy of the zinc regions of New Jersey. A collection of 84 minerals, exhibited by the U. S. Geological Survey at the Cotton States and International Exposition, was turned over to the Museum, and from the same source were received 81 specimens of covellite from Gray Rock mine, Butte, Montana. A specimen of wire silver from Aspen, Colorado, was presented by Dr. A. S. Eakle, and 34 specimens of minerals, chiefly from Connecticut, were obtained in exchange from Wesleyan University, at Middletown.

There has been no radical change in the exhibition series during the year. Two additional cases have been provided for the gem collection, and all of the gems and precious stones have been remounted. A case of specimens illustrating the mineralogy of Sussex County, New Jersey, has been installed.

The progress made in caring for the collections is shown in the following paragraphs, quoted from the curator's report:

The material stored in the armory sheds has been removed to those on Ninth street, giving an opportunity of examining a large number of boxes whose contents were unknown. The greater part of this material was worthless, and the work of assorting and making final disposition of it is still going on.

Work is progressing, though slowly, on the card catalogue of the collections.

The gems have all been weighed, measured, examined with the microscope, and catalogued, and the manuscript for the labels is now in the hands of the printer.

The series sent to Nashville has been enlarged by models and additional specimens, so that upon its return a series defining and illustrating all the properties of minerals, including their optical properties, will be ready for installation.

Some 800 specimens belonging to the old collection, but not catalogued, have been entered and supplied with numbers.

The assistant curator has completed a crystallographic examination of the minerals of Italian Peak, Gunnison County, Colorado, an undertaking requiring over 200 measurements of crystals. He is also measuring or describing crystallographically the specimens in the systematic series, and has already finished the sulphides. A catalogue of the series illustrating the properties of minerals is nearly completed, and a synoptic arrangement of minerals has been prepared and submitted for publication. Mr. Tassin has also investigated the use of iodine in the rapid determination of minerals.

Dr. A. S. Eakle was engaged for a time in the study of the topaz crystals in the collection.

The lack of proper facilities for analytical work is seriously felt, and the equipment of a suitable laboratory would go far toward increasing the value of the collection, which at present contains a large amount of undescribed material.

There were 1,341 specimens received during the year. The last catalogue entry in June, 1896, was 83747, and in June, 1897, 84279, giving a total of 532 entries. It should be stated, however, that a considerable number of specimens received in previous years have but recently been entered on the catalogue.

DEPARTMENT OF GEOLOGY.

The curator, Dr. George P. Merrill, states that there were 86 "regular" and 176 "temporary" accessions received during the year. In the "temporary" accessions, consisting of material received for examination, there was an increase of 16 over last year.

The accessions of greatest importance were the following: From Mr. H. S. Washington, Locust, New Jersey, 42 specimens of volcanic rocks obtained in Italy (gift); from Prof. Frank D. Adams, Montreal, Canada, 14 specimens of rocks from Canada (exchange); a drift bowlder of native copper, obtained by purchase; from the U. S. Geological Survey, 264 specimens of rocks from Nevada City and Grass Valley, California, and 252 microscopic sections of rocks from the same localities; from Prof. C. H. Hitchcock a series illustrating geological sections across Vermont and New Hampshire (exchange); a fine series of spherulitic liparites, described by Dr. Whitman Cross, and transmitted by the U. S. Geological Survey; collections illustrating the petrology of Pike's Peak, Cripple Creek, and Gunnison, Colorado, described by Messrs. Cross and Penrose, and received from the U. S. Geological Survey; rocks from the Tewan Mountains, collected by Maj. J. W. Powell and Mr. W. H. Holmes, and described by Prof. J. P. Iddings, also received from the U. S. Geological Survey; a collection of zinc and lead ores obtained in Cherokee County, Kansas, and presented by Mr. B. Cooley, of Galena; 10 specimens of gold and silver minerals, and 4 specimens of fine native gold and silver, purchased for the Nashville Exposition; a collection of Nepheline rocks of Canada, from Prof. Frank D. Adams, Montreal (exchange); a fine slab of onyx marble from San Luis Obispo, California, obtained by purchase, and a second slab from the same locality, presented by Mr. Frank Kessler, New York City; a large slab of conglomerate from Virginia, showing etched quartz pebbles (purchase); a collection of thin sections of rocks obtained during the survey of the fortieth parallel, deposited by the U. S. Geological Survey.

But few changes have been made in the exhibition series pending the completion of the galleries.

A large quantity of material which has been in storage for a number of years has been overhauled. This included 40 boxes of ores and useful minerals received from the General Land Office in 1885, and a series of ores collected by the Tenth Census Division of the U. S. Geological Survey. The work of assorting and cataloguing these speci-

mens is still in progress. About 600 duplicate specimens were picked out, identified, and labeled. The card catalogue of the exhibition series was nearly completed during the year. The regular work of the department has been interrupted by the necessary preparations involved in building the new galleries, and also to some extent by the preparations for the Nashville Exposition.

A large amount of time has been given to the work of determining and classifying the collections, although some attention has been given to the systematic study of rock weathering. Five papers based upon Museum material have been published by the curator during the year, the titles of which appear in the Bibliography (Appendix IV).

Under the head of explorations, Doctor Merrill mentions a small collection of ores obtained in Mexico by Mr. Edward Palmer, of the Department of Agriculture, and the material turned over to the Museum by the U. S. Geological Survey, already referred to.

A number of specimens and thin sections were lent to specialists for examination during the year, and Mr. Thomas Means, of the Department of Agriculture, and Dr. E. C. E. Lord were occupied for a time in making investigations in the laboratory of the department.

The curator makes the following remarks relative to the further development of the exhibition series:

It is doubtful if, so far as relates to this department as at present organized, the actual amount of exhibition material should be greatly increased. The additional space provided by the galleries will not be more than sufficient for a satisfactory display of exhibits at present installed, and it is believed that better results may be obtained by carefully working up and rounding out existing exhibits than by installing new ones. The opening of the balconies will necessitate an almost entire rearrangement of the materials in the southwest court. It is intended to remove what is known as the systematic series of economic products to this balcony, and install the building stone exhibit in the wall-cases now occupied by the geographic series. This will relieve the overcrowded floor space and render the systematic series more accessible and vastly more attractive.

There were 394 entries in the catalogue during the year, the number of specimens received having been 2,656, besides 1,145 microscopic slides. The number of specimens in the different series is shown in the following statement:

Exhibition series	23,625
Study series	29,908
Microscopic slides	6,000
Duplicates	16,672
Total	76,205

DEPARTMENT OF ETHNOLOGY.

The main dependence of this department for the acquisition of material is divided between the Bureau of Ethnology, the consular service, and the Department of Agriculture. Few military expeditions are now sent to the West, and there are no sources of supply other than those just

mentioned to take the place of the various Government surveys and expeditions sent out in previous years, through which large quantities of ethnological material were acquired. During the year just closed the total number of accessions was 79. Of the material acquired, however, a large proportion was collected under the auspices of the Museum for the purpose of filling gaps in the existing series.

The collection of greatest value was that obtained from the pueblos of Arizona by Dr. J. Walter Fewkes. It consisted chiefly of ancient pottery, and of objects of wood, textile, and stone. The curator, Prof. O. T. Mason, makes the following reference to this material:

> The value of the Fewkes material consists, first, in the fact that the student who is to describe the collection is the one who also made it; secondly, while the modern pueblos have been well studied by the various members of the Bureau of Ethnology, and we have excellent information also from Dr. Seler and others concerning the culture of ancient Mexicans and the inhabitants of Central America, Dr. Fewkes has been able to trace out through this large number of examples the symbolism of the pueblo worship, and to compare it with that of the more cultured regions lying south. It forms, therefore, a connecting link between the study of modern pottery made by other students and the old culture of the architectural tribes in Middle America.

Other accessions embracing material of value for study and comparison are as follows:

From Dr. W. L. Abbott, 121 specimens, obtained in Lower Siam, and 12 specimens from the Malay Archipelago; from the estate of the late Maj. Charles Bendire, a small collection from Dakota and the northern boundary; from Mrs. John G. Bourke, a collection of ethnological objects; from the Bureau of American Ethnology, 233 specimens, collected by Mrs. Matilda C. Stevenson; and other small collections through Mr. W J McGee, Dr. Marcus Baker, and Mr. James Mooney. Thirty-seven specimens from Shanghai, China, were purchased; and there were received in exchange from the Canterbury Museum in New Zealand 16 ethnological specimens, and from the Hon. John Daggett, of California, 18 photographs of Klamath Indians. Dr. J. Walter Fewkes presented 108 specimens from the Moki pueblos, and 20 specimens were received from Mr. A. E. Hippisley. From Mr. E. W. Nelson 242 Alaskan specimens were purchased, and 94 specimens from Durango, Mexico, were obtained in the same manner. Through the Hon. W. W. Rockhill, Assistant Secretary of State, excellent small collections of photographs and other material have been received from consuls in Korea and the far East. From Miss E. R. Scidmore were received 172 photographs obtained in various parts of the world (gift); from Rev. D. W. Snyder, 85 objects from Africa (exchange); from Miss M. A. Tribolet, 22 specimens from Burmah (gift).

A collection of objects from the Seminole Indians of Florida was purchased. Excellent service in the way of collecting from the tribes in the Indian Territory has been performed by Mr. James Mooney, of the Bureau of Ethnology.

In speaking of the exhibition and study series Professor Mason says:

So far as the limited space will allow, the study series is in good condition. A portion of it is arranged ethnically and the remainder technically. Especially are those objects which have been gathered in the Orient placed ethnically, because there is in no case a sufficient amount of material to permit of a satisfactory comparative study. For the American series, the material being much more comprehensive, it has been possible to lay out certain large ethnic or culture areas, and to regard the whole western world as one enclave. In these areas comparative studies of considerable range can be made, and therefore objects belonging to each culture class are placed together.

The exhibition series is not in its best condition at the close of the fiscal year, because several months of the curator's time have been devoted to the preparation of an exhibit for the Nashville Exposition, and it has not been possible to give proper attention to this part of the collection. The construction of new galleries has also interfered with this portion of the work. It is hoped that in some way additional exhibition space may be provided for the ethnological exhibit. The specimens have been carefully guarded from destruction by moths or otherwise, and those belonging to the study series have been made as accessible as possible.

The curator states that all of the material assigned to him during the year has been catalogued, cleaned and, when necessary, poisoned. Catalogue cards have also been made out for a large number of the specimens. The constant transfer of specimens from the study to the exhibition series makes it difficult to keep all of the material exhibited, properly labeled. Additional assistance is necessary for the purpose of continuing the work of checking off on the catalogues such specimens as have been sent out in exchange during past years.

Since the beginning of the fiscal year the curator completed the proof reading of his paper on "Primitive Travel and Transportation," which was published in the Report of the National Museum for 1894. He has also published several other papers, the titles of which will be found in the Bibliography (Appendix IV), together with the titles of papers published by Dr. Fewkes, Dr. Hough, and Mr. J. D. McGuire.

Professor Mason has devoted as much time as possible to bringing together and studying material for an exhaustive monograph of the arts connected with the animal world. A large number of specimens and many drawings have been gotten together, and it is hoped that the work will be ready for the press during the coming year. Mr. Stewart Culin, of the University of Pennsylvania, is still studying the Museum collection of games.

The Royal Scottish Museum recently sent to the U. S. National Museum a number of photographs of objects known to have been collected by the celebrated geographer Capt. James Cook. These had been incorrectly labeled, and it was desired to have them compared with the large collection here. This matter has now been attended to.

The following statement regarding scientific work accomplished, and services rendered by persons not connected with the Museum, is of interest:

Investigations of great importance have been prosecuted in the department of ethnology during the past year. Mr. J. D. McGuire continued his studies of the

pipes of the North American aborigines, and the pictographic work of the Eskimo has occupied the attention of Dr. W. J. Hoffman. Dr. Fewkes spent the winter in preparing an elaborate report of his researches in Arizona during the past two years. Mr. E. W. Nelson, who spent three years in Alaska in the early eighties, and who was subsequently compelled to go to Arizona on account of ill health, recently returned to Washington and prepared, with the aid of the force connected with the department, a monograph of his collection, consisting of 7,000 objects. So long had this work been delayed, and so necessary to general ethnology was it that Mr. Nelson, who with his own hands collected these treasures, should prepare an account of his explorations, that the curator deemed it of the utmost importance that every other duty should be laid aside in order to push forward as rapidly as possible this ethnographic study. The work has now been finished, and the manuscript has been sent to the Bureau of Ethnology for publication. Hundreds of drawings and many photographic plates were carefully made in order to illustrate the monograph. It is also worth mentioning that with the cooperation of Mr. Nelson all of the specimens in our collection kindred to those which he brought together, have attained additional importance.

It would be impossible to name all the persons who have willingly served the department of ethnology during the past year, but especial attention is called to the services rendered by the following persons: Mr. Tappan Adney worked up the classification of canoes and traps according to forms; Mr. Henry Balfour studied the Asiatic bow; the Hon. John Daggett, of California, studied the material, dyes and technique of California Indian basketry; Mr. Samuel J. Entrikin, Chester, Pennsylvania, gave information concerning the structure of the Eskimo dog harness; Dr. J. Walter Fewkes gave information regarding the industrial life of the pueblo Indians; Dr. J. W. Hudson, Ukiah, California, studied the various stitches used in California basketry; Dr. W. J. Hoffman studied the methods of mat making among the Chippewa tribes; Miss Elizabeth Lemke, of Berlin, investigated the distribution of looms of Germany; Mr. J. D. McGuire, Ellicott City, Maryland, studied the art of stone working; Mr. E. W. Nelson gave information on many details connected with the technique of the Alaskan Eskimo. Rev. G. B. Winton, San Luis Potosi, Mexico, transmitted valuable collections illustrating the survival of ancient Indian arts among the modern tribes, and of old Spanish culture in the folk Mexican life. Mr. F. V. Coville has become interested in the study of plants used by the Indians of our western country for food, narcotics, clothing, houses, textiles, etc.

Professor Mason again calls attention to the desirability of directing special effort to the acquisition of such material as will fill gaps in the present series and of acquiring material for new series. He refers to a paper which he recently published in the Report of the Smithsonian Institution,[1] in which he has elaborated eighteen culture areas in the Western Hemisphere and divided the products of human activity into seven large classes, indicating in a table what constitutes the necessary data for a correct study of the ethnography of these culture regions. He suggests the advisability of preparing, in connection with this, a statement showing what the Museum already possesses and what is still desired, in order that the National Museum may, as far as possible, present a complete history of the culture of all the tribes which have lived upon the American continent.

The total number of specimens received during the year, including the pueblo material above referred to, is 3,834, and the number of catalogue entries 2,721.

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[1] Report of the Smithsonian Institution, 1895, pp. 639-665.

DEPARTMENT OF PREHISTORIC ANTHROPOLOGY.

The curator of this department, Dr. Thomas Wilson, states that the material received during the year has been fully up to the general average, so far as scientific value is concerned. The total number of permanent accessions was 117, while 52 lots of material were received for examination and report.

The accessions of special importance are as follows:

Dr. Roland Steiner of Groveton, Georgia, deposited a large collection, consisting of more than 10,000 specimens of implements and other objects from an aboriginal village site on the Kiokee Creek, Columbia County, Georgia. From the Bureau of American Ethnology was received a collection of antiquities found in mounds and stone graves in Missouri and Illinois. The material consists principally of pottery bowls and vases, although there are a number of stone implements and other objects. The collection included altogether about 350 specimens. The U. S. Fish Commission transmitted 44 archeological objects found while excavating for fish ponds at its station at San Marcos, Texas, and a collection of about 350 specimens from the same locality was received from Mrs. Joseph D. Sayers. Another collection from the Bureau of Ethnology consisted of 240 prehistoric stone implements from different localities in Colorado and Kansas. These were collected by Messrs. G. K. Gilbert and F. H. Newell of the U. S. Geological Survey. Dr. Thomas Wilson deposited a series of 19 objects from a stone grave near Nashville, Tennessee, and a collection of 64 objects from the Noel Cemetery, Glendale Park, near Nashville. From the Smithsonian Institution was received a collection of implements and other objects gathered by Miss Emma Delafield while traveling in Mexico several years ago. Dr. Thomas Featherstonhaugh of Washington, District of Columbia, presented 55 objects found in a burial cave near Lake Apopka, southern Florida. Miss Georgie L. Leonard, Washington, District of Columbia, deposited a hook of native hammered copper, found in the glacial drift in the valley of the Sault Ste. Marie River, on the Michigan side.

Other collections were: From M. de Morgan, Gizeh Museum, Cairo, Egypt, a collection of 252 specimens (exchange); from Mr. Clarence B. Moore, 1321 Locust street, Philadelphia, a large pottery burial urn from a mound in Bryan County, Georgia (gift); from Mr. Henry S. Washington, Locust, New Jersey, a rude stone ax or pick found at Beni Hassan, on the Nile, Egypt, also a hammer stone from Greece, (gift); from Mr. Byron E. Dodge, Richfield, Michigan, a collection of 30 specimens found in Genesee County, Michigan (deposit); from Dr. Felix Adler, New York City, 30 specimens of pottery obtained from a cave at Dos Caminos, near Acapulco, Mexico (exchange); from Mr. J. W. Emmert, Bristol, Tennessee, 394 specimens, principally from Sullivan County, in that State, (purchase); from the Canterbury Museum, Christchurch, New Zealand, 11 flint knives, scrapers, etc. (gift); from

Mr. George H. Scott, Sault Ste. Marie, Michigan, a small spear-head from Bar River, Ontario, Canada; from the Royal Museum of Natural History, Brussels, Belgium, 82 casts of animal bones and implements, the originals of which were obtained from various caverns in Belgium; from Mr. John M. Foss, Forbestown, California, a collection of implements from Yuba County, in that state (gift); from Mr. H. W. Beckett, Woodbury, New Jersey, a collection of 45 objects from his vicinity (gift); from Mr. Elias Richards, New Orleans, Louisiana (through the Bureau of Ethnology), a polished spade-like implement of dark green chlorite (exchange); from Mr. H. C. Duvall, Washington, District of Columbia, 4 specimens from various localities (gift); and from Mr. John C. Abel, Lancaster, Pennsylvania, 201 specimens from the Conestoga Hills, near Lancaster (gift).

The exhibition series is in as good condition as at any previous time. Many labels have been added, and others are in course of preparation. There is no separate study series in the department. During the year there have been no radical changes, so far as the installation of the collection is concerned. The routine work of the office (including the examination of a large number of objects sent to the Museum for that purpose) has been heavy. In addition to this, however, the department prepared an exhibit, consisting of nearly 1,000 specimens, for the Tennessee Centennial Exposition. The work of preparation was performed mainly by Mr. Upham, the installation of the collection being superintended by Dr. Wilson. The transfer to this department of the collection of prehistoric pottery, which has recently been completed, has added considerably to the work of the office.

In the early part of the fiscal year Dr. Wilson completed the proof-reading, etc., of his paper on the Swastika. He has also prepared a descriptive catalogue of the Steiner collection, and has devoted a considerable amount of time to other papers.

The curator has continued to fill the position of professor of prehistoric anthropology in the National University in this city, where he delivered a series of lectures during the year.

The following explorations have resulted in enriching the collections of the department:

Dr. Roland Steiner has continued his investigations into the Kiokee village site in Columbia County, Georgia.

Mr. John C. Abel, of Lancaster, Pennsylvania, has continued his investigation of the Conestoga Hills in his neighborhood.

The curator, while at Nashville, engaged in work connected with the Tennessee Centennial Exposition, spent three days in making investigations among the stone graves which are to be found in abundance in that locality. He procured the entire contents of one of the graves, including the stone coffin and pottery floor, and brought them with him to the Museum, where they will be placed upon exhibition.

Prof. G. K. Gilbert and Mr. F. H. Newell, of the U. S. Geological Survey, collected 240 archæological specimens during a reconnoissance in the plains regions of the Arkansas River in eastern Colorado.

M. Jacques de Morgan, of the Gizeh Museum, Cairo, Egypt, sent to the U. S. National Museum 252 specimens of neolithic flint implements collected by himself.

Dr. Wilson was appointed by the Secretary of State to act as commissioner on behalf of the United States to the International Exposition, which opened at Brussels in April, 1897.

About 200 specimens were lent to Mr. J. D. McGuire for use in connection with the preparation of his paper on prehistoric pipes.

Several persons have made special studies of the collections in the department, as will be seen by reference to the chapter on the work of students and investigators.

The titles of those papers published by the curator during the year which are based upon Museum material are given in the Bibliography (Appendix IV).

There has been no material change in the plans of the curator for the future development of the department. These were set forth quite fully in the last Annual Report.

There were 13,840 specimens received during the year. The total number of specimens in the department was given in the last Report as 209,346. The number of specimens transferred to this department from the former section of American aboriginal pottery is estimated at 20,000, and 15,981 casts, made for distribution to scientific and educational institutions, are now accounted for for the first time. This gives a total of 250,167. Deducting the number of original implements and casts distributed during preceding years and not accounted for, and also those sent out during the current year (in all 8,911), the number of specimens in the department is shown to be 250,256.

The last catalogue entry in June, 1896, was 173061, and in June, 1897, 195271, giving a total of 22,210 entries. The number of specimens received for examination and report during the year was 174.

DEPARTMENT OF ARTS AND INDUSTRIES.

Technological collections.—Mr. J. E. Watkins, curator, has submitted separate reports upon the several series embraced in the technological collections. These collections are gradually being brought into better condition; although, since the appointment of Mr. Watkins as chief of the division of buildings and superintendence, it has not been possible for him to devote much time to matters pertaining to the technological exhibits. Such work as has been performed has been done with a special view to bringing together and preserving those objects which are representative of epoch-making inventions.

Mr. George C. Maynard has rendered important service as custodian of the electrical collections. The prospects for building up an interesting series of historic electrical apparatus are very gratifying, and substantial progress has already been made.

The following tentative classification of the technological collections has been adopted for convenience in administration:

- Transportation and engineering:
  - Transportation by land—
    - Vehicles without wheels.
    - Vehicles with wheels.
  - Transportation by water—
    - Rafts and primitive crafts.
    - Sailing vessels.
    - Steamboats and steamships.
  - Electrical engineering—
    - Telegraph.
    - Telephone.
    - Light and heat.
    - Motors, stationary and for traction.
  - Machines and appliances of historical interest.
- Textiles (arranged to show the history of the art of weaving).
- Animal products (arranged to show the result of human effort in utilizing the products of the animal kingdom).
- Foods (arranged to show the adaptation of the products of the animal, vegetable, and mineral kingdoms to supply food for man).
- Physical apparatus.

The most important addition to the transportation collection, from an historical point of view, was a poster, dated October 9, 1821, of a stage-coach line between Providence, Rhode Island, and Worcester, Massachusetts. This poster was presented by Mrs. S. H. Olmstead. The first machine used in the manufacture of baskets, known as the Horton automatic basket machine. was received from Mr. R. G. DuBois, Washington, District of Columbia. The original working model of the first boiler-riveting machine, using steam as the power, was presented by Mr. Charles H. Haswell, New York City.

In this section the exhibition and study series are combined. and the collections are in fair condition, considering the limited space available. Very little progress has been made in administering upon them during the year, owing to the fact that the time of the curator has been taken up with other matters. A small synoptical series was prepared for the Tennessee Centennial Exposition. Whenever additional space shall be provided, the collection will be entirely rearranged.

Three entries were made in the catalogue during the year, embracing the same number of specimens.

The electrical collections have been increased through the courtesy of Miss Mary A. Henry, who deposited additional specimens relating to Professor Henry's discoveries in electro-magnetism. Some pieces of apparatus were also received from the Smithsonian Institution. Regarding this collection Mr. Maynard says:

> An effort has been made to assemble and place on exhibition the Henry relics, for which a suitable case has been provided. In this undertaking the Museum has received the valuable cooperation of the daughters of Professor Henry, who have deposited many valuable objects illustrating his work and showing in some measure the recognition he received for it from scientific men throughout the world.

A considerable number of pieces of Henry's experimental apparatus has also been received from the Smithsonian Institution. The apparatus made by Henry in 1831 for Yale University, and deposited by that institution, and other apparatus illustrating the important original work done by Henry, also form part of the collection. At this time, when the whole world is enjoying immense benefits from numerous electrical appliances which have grown out of the discoveries made by Henry in his early researches, this apparatus used by him, much of it constructed with his own hands, possesses an intense interest. It forms a suitable beginning for a collection of historical electrical apparatus showing the various stages in telegraphy, telephony, electric lighting, and kindred industries, the history of which—yet to be written—reflects much credit upon Joseph Henry and the Smithsonian Institution.

Mrs. Isabella Field Judson presented a large number of objects relating to the laying of the early trans-Atlantic telegraph cables and the work of Cyrus W. Field in connection with that enterprise. This collection includes specimens of the original cables preserved by Mr. Field himself, with his charts and autograph records of the first cable-laying expeditions.

The Western Union Telegraph Company and the Telegraphic Historical Society deposited several specimens of original apparatus showing the development of the telegraph in this country. Mr. F. W. Hawley, of New York City, presented an electric motor which was operated by a current generated at Niagara Falls and transmitted to New York City, a distance of 453 miles, over commercial wires of the Western Union Telegraph Company.

A large number of interesting and important objects can not be placed upon exhibition owing to lack of space.

A great deal of time has been devoted to the classification and arrangement of the collections, the preparation of a catalogue, and an investigation of the history and authenticity of numerous objects not heretofore fully identified and described.

Models illustrating some of the discoveries and inventions of Franklin, Henry, Morse, and Page were sent to the Tennessee Centennial Exposition.

Correspondence has been entered into with Mr. Thomas A. Edison, Prof. Elihu Thomson, Mr. Charles F. Brush, the General Electrical Company, the Western Union Telegraph Company, and other individuals and firms prominent in electrical matters, and gratifying assurances of cooperation have been received. Assistance in furnishing information or in searching for historical objects has been rendered by the following persons: Gen. Thomas T. Eckert, president of the Western Union Telegraph Company, and Messrs. C. A. Tinker and A. S. Brown, of the same company; Mr. Edward L. Morse, Yonkers, New York; Dr. Henry M. Field, New York City; Mr. T. C. Martin, editor of the Electrical Engineer, and Mr. S. H. Kauffmann and other officers of the Telegraphic Historical Society.

Work has been outlined for the future as follows:

The more perfect classification and arrangement of the objects now belonging to the collections and the completion of an accurate catalogue and historical record of

them; the gradual establishment of a complete collection of historical apparatus showing the development of the art of generating electricity and its application to various scientific and industrial purposes, such as telegraphy, telephony, electric lighting, power, heat, etc.; the preparation of a series of models of epoch-making apparatus illustrating the more important discoveries in electrical science, commencing with the voltaic pile and continuing down to the intensity magnet of Henry.

Two hundred and fifty-three specimens have been received, the total number in the collection being 395. There were 276 entries in the catalogue.

The additions to the collection of naval architecture show an increase in value over the specimens received in the preceding year. A small pamphlet entitled A Treatise on the Application of Steam, by James Rumsey, published in 1788, constitutes the most important accession. This was presented by Thomas Rumsey. A model of the ship *America*, in which all the sails and important parts—about 425 in number—are labeled, was constructed and sent to Nashville for exhibition at the Tennessee Centennial Exposition. A model of the ship *R. F. Stockton*, the first steamboat with an iron hull and also the first steamboat with a screw propeller to cross the Atlantic, was built and placed on exhibition in the Museum.

The collection of naval models is not fully labeled, but it is hoped that arrangements may be soon made for having this work done. The wall-cases in the exhibition hall have been enlarged, rendering possible the better arrangement of the models. Although no study series exists, the needs of the student have been considered in the arrangement of the exhibition series, and they will also be considered in the preparation of the labels. Many of the models are in need of repairs, and this matter will also receive attention. It is proposed to complete the series, so far as the means at command will allow.

Five specimens were received during the year, involving the same number of catalogue entries. The total number of specimens in the collection is estimated at 1,336.

There have been no additions during the year to the collection of textiles. A large number of unit boxes have been overhauled and a tentative exhibit arranged. As soon as the galleries are completed, it is hoped that an opportunity will be afforded to permanently arrange the exhibition series. Labels should also be provided and the gaps filled, as far as possible, with material now in storage. The study series requires attention as well.

A tentative arrangement of the exhibition series of the collection of animal products has also been effected. It is hoped that considerable progress may be made during the coming year both with the exhibition and the study series.

The collection of physical apparatus, formerly in charge of Mr. W. C. Winlock, has been placed in the care of Mr. Watkins, but it has not yet been possible to give the collection the attention which it deserves.

Historical collections.—There has been a decided increase in the number of specimens received during the year, as well as in their scientific value. The number of accessions or lots of material has not, however, been above the average, there having been 43 "permanent" and 19 "temporary" accessions.

The most important additions were as follows:

A collection of the coins of the Chinese Empire from 770 B. C. to date, comprising 2,025 pieces in gold, silver, and bronze, and including governmental and private notes, amulets, and bamboo tallies. This collection was bequeathed to the Smithsonian Institution by Mr. G. B. Glover, an American gentleman connected for many years with the Maritime Customs Service of China. It is believed to be the most complete series of Chinese money in the world.

A collection of bronze medals of the sovereigns of France was obtained by purchase. The series comprises 75 pieces, all of which are in perfect condition.

Mrs. A. B. Van Deusen deposited a collection of ceramics, consisting of 204 plates, pitchers, etc., illustrative of American history.

A collection of relics of the Revolutionary war was deposited by the Society of the Daughters of the American Revolution.

A sword presented to Gen. Gabriel R. Paul by his command was deposited by Col. Augustus C. Paul, Soldiers' Home, Hampton, Virginia.

Mrs. Abner Doubleday transmitted a sword worn by General Doubleday during the war of the Revolution.

Students of history have in a number of instances received permission to make photographs or drawings of objects on exhibition, to be used in illustrating works intended for publication, especially in connection with the biographies of General Grant and other soldiers of the late war. The Washington relics have frequently been examined by writers of colonial history.

That portion of the collection which is on exhibition is in good condition, and there are many objects of historic interest which could be advantageously displayed if there were room. Much remains to be done in arranging the study series.

Mr. A. Howard Clark, custodian, makes the following statement with reference to the work performed in caring for the collections:

> During the past three months much progress has been made in cataloguing and permanently arranging the valuable collection of coins and medals belonging to the Museum. Several series have been placed on exhibition, and the difficult problem of installing large series of coins has been solved by the use of upright cases with sloping diaphragms covered with olive-green velvet.
>
> A great deal remains to be done to complete the labeling of the collection, but the work is steadily progressing.
>
> The series of portraits of representative men has been increased somewhat, and the entire collection has been arranged for ready reference.

Considerable time was devoted to the preparation of a collection of medals and coins pertaining to the colonial period of American history, for display at the Tennessee Centennial Exposition at Nashville.

It is proposed to build up and exhibit a complete series of the present coinage of all countries, and to provide labels showing the commercial and intrinsic value, fineness, and comparative value with the coins of the United States. Such a collection, it is believed, would be of great interest to the public and to students.

A very large series of medals of various countries is now in storage but inaccessible to the public. This will be placed upon exhibition as soon as the necessary space is provided, as will also a series of portraits of representative Americans, such as was shown by the Museum at the World's Columbian Exposition in 1893.

The number of specimens received during the year was 3,441, and the total number of specimens in the collection is estimated at about 35,000. There were 441 entries made in the catalogue.

Oriental antiquities and religious ceremonials.—Dr. Paul Haupt remains in charge of the collection of oriental antiquities as honorary curator, while Dr. Cyrus Adler holds the position of assistant curator in this department and also that of custodian in the section of religious ceremonials.

Although the number of accessions for the year was considerably less than for the preceding year, the number of specimens included in these accessions shows an increase of more than 100 per cent. The material received during 1896–97 is also of greater scientific value.

From St. John's College, Shanghai, China, a collection of objects used in Buddhist worship and illustrating the form of the ceremonial of that religion in China was received in exchange. A small collection of Buddhist and Mohammedan objects from India was purchased, as was also a collection of objects of Christian ceremonial. While many of the other accessions contained material of interest and value, these were the most important.

In the chapter entitled "Development and arrangement of the exhibition series" will be found a statement relating to the present condition of the collections on exhibition and the changes recently made.

An exhibit comprising 167 objects was prepared for the Tennessee Centennial Exposition at Nashville.

Dr. Adler has completed a description of the exhibit of Biblical science at the Cotton States and International Exposition at Atlanta, embodying also the results of recent discoveries and researches in the domain of Biblical and oriental archæology. This paper is published in Part II of the Report of the National Museum for 1896. A study of ancient oriental seals is in progress.

During the year a number of persons have received information or assistance in one way or another with reference to antiquities.

Dr. Adler has prepared and published a short paper on the Cotton Grotto, an ancient quarry in Jerusalem, and Dr. I. M. Casanowicz published in the American Anthropologist during the year a paper entitled "Tel-et-Tin on Lake Homis, in the Valley of the Orontes."

It is proposed to rearrange and relabel a portion of the Egyptian collection and to reinstall the Jewish and Mohammedan collections. The method of arranging and exhibiting objects of Christian ceremonial in other museums will be studied.

About 270 labels for specimens have been prepared during the year.

Dr. Adler states that it is desirable that opportunity and facilities be afforded for the preparation of a description of the Benguiat loan collection of Jewish ceremonials, which is one of the most complete and valuable collections of its kind in existence.

The total number of specimens received was 628, the number of specimens now in the collection being 3,618. There were 50 catalogue entries made during the year.

Graphic arts.—Although Mr. S. R. Koehler, of the Boston Museum of Fine Arts, is still in charge of this section, he has been able to give but little attention to the work during the past year. The most important accession was a series of photographs from paintings, obtained by purchase. The only other addition was a chromo-collograph, presented by the Heliotype Printing Company of Boston.

As previously stated, the collection has now reached a stage where very few additions of value can be expected, except by purchase.

Materia medica.—Dr. James M. Flint, U. S. Navy, honorary curator, states that the specimens in the exhibition and study series are in remarkably good condition, considering their perishable nature. For a considerable portion of the year the exhibition series, which is installed in the northeast court, was not accessible to the public owing to the preparations for the Tennessee Centennial Exposition, which made it necessary to close some of the halls temporarily. After this work had been completed and the exhibit again rendered accessible, the specimens were carefully examined and everything put in order. No effort has been made to increase the collection, owing to lack of space for the exhibition of any more material. Manuscript for a number of labels has been prepared.

As it is impossible under present conditions to do very much toward the further development of the collection, Dr. Flint has given a large proportion of his time to the investigation of the Foraminifera collected by the U. S. Fish Commission. As a result of his studies he has prepared a paper entitled "A Descriptive Catalogue of the Recent Foraminifera collected by the U. S. Fish Commission steamer *Albatross*, and now on exhibition in the National Museum." This paper is printed in Part II of the present volume. A reference was made in the last annual report to the instrument devised by Dr. Flint for the exhibition of Foraminifera and other microscopic specimens.

The curator states that the direction in which the collection of materia medica can be most advantageously extended is toward a more complete exhibit of organic chemical products, now so extensively used in medicine.

Only five specimens were added to the collection during the year and none of them were of particular importance. The total number of specimens now in the collection is 6,330.

Musical instruments.—There were three accessions of importance during the year. Dr. W. L. Abbott presented 11 musical instruments, collected during his travels in the east, and Messrs. H. A. and F. H. Vinton, of Bedford, New York, presented a spinet supposed to have been made about the middle of the seventeeth century. A few Chinese musical instruments were collected for the Museum by Lieut. C. G. Calkins, U. S. N.

Photographic collection.—Mr. T. W. Smillie was on July 15, 1896, designated custodian of the collection illustrating the history of photography. Although the photographic exhibit is recognized for the first time in the present Report as an established section, as long ago as 1888 a series of specimens showing the uses of photography was prepared for the Ohio Centennial Exposition, held at Cincinnati. This collection included portrait and landscape cameras of early types, a complete daguerreotyper's outfit, and examples of cameras of various kinds in use at the time of the Exposition. The daguerreotype, talbotype, albumen, collodion, and gelatine negative processes were also illustrated. There were examples of prints made by various processes, of transparencies, and of transferotypes on paper, canvas, and porcelain. Another series was intended to show the value of photography in the study of astronomy, geology, biology, and medicine, as an aid to the artist and engraver and to the scientist in recording the fluctuations of various instruments.

Since the Exposition at Cincinnati a considerable quantity of material has accumulated, especially during the past two or three years, and there is every reason to believe that a valuable and interesting collection can be built up. The design is to bring together an exhibit illustrative of the history and uses of photography, beginning with the earliest authentic discoveries in the art and grouping them chronologically up to the present day.

The following statement, taken from the report of Mr. Smillie, indicates the scope of this collection and the plans for its further development:

> The collection includes a fine series of portrait, landscape, and marine daguerreotypes; an original daguerreotype of Daguerre; also a panoramic view, about 4 feet long, of the harbor of San Francisco in 1852, showing the dismantled fleet of the Argonauts, a remarkable piece by Shew, of California.
>
> There are also specimens of the ambrotype, crysotype, the asphalt process, the various silver processes, the carbon process, the aniline process, etc. In fact, the collection, although small, is so rich in the earlier processes, which are passing away, that it will be comparatively easy to fill up the blanks.
>
> At the photographic exhibition recently held in the hall of the Cosmos Club in Washington the Museum secured, partly by purchase and partly by donation, over 50 examples of the best work of the present day by the leading amateur and professional photographers of the United States.

Comparatively little has been done to illustrate the work of the last ten years, and an effort is now being made to complete the series, so that it will be a worthy representation of the progress of the art. The acquisition of the prints from the Washington Exposition of 1896 is a step in this direction.

An effort will be made hereafter, especially in connection with the future expositions of amateur work, to secure such specimens as are necessary to make the collection in the National Museum a reference and record collection, which shall be not only of interest and pleasure to the public, but of practical value to photographers themselves.

It is unnecessary to enlarge upon the importance which such a collection as this must have to every photographer—a collection in which he may see, side by side, the best works produced from year to year, and study the effects of light and time upon the permanence of paper and processes.

The pictures recently bought by the Museum were chosen with the idea that they represent as fully as possible the different schools of amateur photography in America at the present time and the work of as many as possible of the most characteristic and representative artists. The fact is fully recognized that the development of these schools is sought in amateur photography rather than among professional photographers, whose work is of necessity more conventional in its character and affords less opportunity for originality and progress, although the fact was recognized that several professional photographers were represented in the exhibition, and characteristic specimens of the work of each of these were also secured.

Owing to the pressure of other work, Mr. Smillie has found but little time to devote to the development of the photographic collection during the year covered by this Report. Forty-seven specimens were received, all of them being unsolicited donations. Miss L. Bernie Gallaher presented 20 daguerreotypes, 3 ambrotypes, and 1 melanotype; Miss Frances Benjamin Johnston contributed a platinum portrait; Mr. C. W. Canfield a stereoscopic melanotype; Mr. J. W. Osborn 19 portraits of celebrated photographers, and Mr. Alexander Beckers 1 hand stereoscope and 1 revolving stereoscope.

The total number of specimens now in the collection is 1,284.

It has been necessary to devote some attention to the preservation of the specimens, many of the old and valuable daguerreotypes showing signs of fading from exposure to the air. These have now been resealed.

The work of preparing specimens for exhibition has been carried on as opportunity permitted.

IV.—REVIEW OF WORK IN THE ADMINISTRATIVE DEPARTMENTS.

FINANCE, PROPERTY, SUPPLIES AND ACCOUNTS.

In Appendix VIII will be found a statement showing the amount of the appropriations for the present fiscal year, the disbursements during the same period, and the balance available June 30, 1897, for the purpose of meeting outstanding liabilities.

The following remarks are quoted from the report for the current fiscal year, submitted by Mr. J. L. Willige, acting chief clerk:

On January 27 Mr. W. V. Cox was designated by the Secretary as special representative at Nashville of Dr. True, representative of the Institution and the Museum on the board of management of the Government exhibit at the Tennessee Centennial Exposition. It is probable that he will remain in Nashville almost continuously until the close of the exposition.

On the 2d of February Mr. J. L. Willige was, upon the recommendation of the acting assistant secretary, designated acting chief clerk, and on the 12th of the month assumed charge of the office.

There has been a considerable increase in the work of the office in certain directions. In addition to the preparation of financial statements and other information required in regular course, the following classes of routine work may be particularized: More than 1,600 orders for the purchase of supplies and the performance of services have been issued on approved requisitions (an increase of approximately 200 over the preceding year); nearly 1.200 inside requisitions have been registered on account of supplies furnished from the stock in the property clerk's office, and services performed by the regular employees of the Museum; record has been kept of requisitions for articles of furniture and fixtures already made and in stock; approximately 900 vouchers have been examined and certified to the disbursing clerk for payment, and more than 1,500 pages of letters and memoranda have been copied in the letter-press books.

The participation of the Institution and its dependencies in the Tennessee Centennial Exposition, which opened at Nashville on the 1st day of May and will continue until the 31st of October next, devolved a considerable amount of extra work upon the office. The work has been accomplished, however, without additional clerical service. There were issued on account of the Exposition 211 orders for the purchase of specimens and material and for the performance of special services; 375 pages of letters were written, and 126 vouchers, aggregating in payments $11,911.42, were prepared, in addition to statements of expenditures and liabilities, showing the condition of the allotment from time to time.

The placing of the several dependencies of the Institution within the limitations of the civil-service law necessitates additional records and correspondence, and 233 reports and letters written are chargeable to this account.

An elaborate statement, in tabulated form, has been prepared, showing the amounts appropriated by Congress for the support of the bureaus under the direction of the Institution, and the aid rendered from the Smithsonian fund and other sources, from the date of the Wilkes exploring expedition in 1836 down to the present year.

The offices of superintendent and assistant superintendent of buildings and labor were abolished October 19, 1896, and the division of buildings and superintendence created. Mr. J. E. Watkins was designated chief of the division, with instructions to report directly to the executive curator.

The membership of standing committees at the beginning of the present fiscal year was as follows: On inspection, Mr. Lucas (chairman), Messrs. Goldsmith and Hawley; on condemnation, Mr. Brown (chairman), Messrs. Goldsmith and Steuart; on lumber, Mr. Horan (chairman) and Mr. Goldsmith, with W. H. Haney as advisory member. On July 8 Mr. Tassin was designated a member of the committee on inspection to replace, temporarily, Mr. Lucas, detailed for duty in Alaska. The committee on lumber has been reduced to Messrs. Goldsmith and W. H. Haney.

Special committees were appointed during the year, as follows: Professor Mason and Messrs. Schuchert, Newhall, Watkins and Brown, to examine Museum material in storage at the Armory Building, with a view to condemning any objects no longer serviceable; Messrs. Goldsmith, Steuart, Schuermann, Berry, McDevitt, and Baker, to open bids for furnishing supplies during the current fiscal year and to recommend awards; Messrs. Goldsmith, Bean, Berry, Schuermann, McDevitt, and Baker, to open and examine proposals for furnishing supplies during the coming year; Messrs. Tassin, Richmond, and Bean, to examine, with a view to condemnation or other disposition, certain books and labels in the editor's office.

The various bureaus of the Smithsonian Institution having been made subject to the civil-service law by order of the President, a classification of the employees was transmitted to the Civil Service Commission on July 3, 1896, together with a tabulated statement of the number of employees in each class.

The civil-service rules require that the head of each department or bureau of the Government shall nominate not less than three persons who shall be members of a board of promotion, and in accordance with this regulation the following officers were nominated as members of the Smithsonian board: Mr. W. V. Cox, chairman, Prof. O. T. Mason, and Dr. Frank Baker. On June 8, 1897, Mr. J. L. Willige, acting chief clerk, was instructed to act as chairman of the board during the absence of Mr. Cox on duties connected with the Tennessee Centennial Exposition. By direction of the Secretary, the chief clerk of the Museum will be chairman *ex officio*. All correspondence between the Commission and the Institution relating to the Museum or to the other Bureaus of the Institution will be conducted through the office of the Secretary by the chief clerk of the Museum.

The Assistant Secretary of Agriculture invited the cooperation of the Smithsonian Institution in establishing a uniform standard of requirements for scientific assistants in the several bureaus of the Government.

the object being to secure assistants with any desirable combination of qualifications and to simplify the operations of the civil-service law so far as these bureaus are concerned. Assurance was given of hearty cooperation on the part of the Institution.

Considerable attention has been devoted to systematizing the records and files relating to civil-service matters. A card catalogue has been started, upon which decisions of the commission are recorded; also a catalogue embracing the names of all employees of the Smithsonian Institution and its dependencies.

During the year there have been fifteen requests for certification of eligible applicants for appointment, nine transfers from the Institution to the several departments, four reinstatements, and eight emergency appointments. Twelve monthly reports have been submitted and 163 letters written relating to civil-service matters.

Upon recommendation of the chief clerk, and with the approval of the Secretary, a law reference library has been established. It is intended to include in this library publications relating to the origin and establishment of the Institution and the Museum, the Revised Statutes of the United States, Journals of Congress, decisions of Comptrollers, opinions of the Attorney-General, reports of the Civil Service Commission, directories, and other works of reference. Through the courtesy of the Secretary of State, a copy of the Revised Statutes and supplements has been received during the year. The reports of the Civil Service Commission have been added, and a series of Congressional Records and Globes—more than two hundred volumes in all—have been transferred from the general library of the Institution. Mr. W. W. Karr, Dr. Cyrus Adler, and Mr. W. I. Adams were designated by the Secretary as a committee to cooperate with the chief clerk in the selection of books for the library.

The oath of allegiance has been administered to all of the employees of the Institution and its bureaus, as required by law.

The attention of Congress has been called to the necessity of increasing the scientific staff and enlarging the force of clerical employees, watchmen, laborers, and cleaners.

It was estimated that the sum of $8,000 would be required to make all necessary repairs to the Museum building during the coming year, but only half that amount has been appropriated for this purpose. Attention was also called to the need of additional skylights. No appropriation has, however, been made for use in this direction.

In the sundry civil act for 1896–97 the sum of $8,000 was appropriated for the erection of galleries in two or more halls of the Museum building. Steps were promptly taken toward the construction of the galleries thus provided for, and on November 25, 1896, a committee, composed of Mr. Cox (chairman), Mr. Watkins and Mr. Lucas, was appointed to consider plans and recommend the award of contracts. Later, Prof. O. T. Mason was designated to act as a member of the

committee, to serve in the place of Mr. Lucas, who had been assigned to special duties in connection with the Fur-Seal Commission. The chairman was relieved on June 5 by Mr. Willige, acting chief clerk. Contracts for the construction of the galleries were duly awarded and the work has progressed satisfactorily. In the appropriation for the fiscal year ending June 30, 1898, an additional sum of $8,000 has been provided for the continuation of the construction of galleries, thus allowing for their extension into the east, west and south halls.

A reference was made in the last Report to the lease of new premises for workshops and storage purposes. A formal agreement was entered into on July 1, 1896, for the present fiscal year, with the privilege of renewal for five years, if desired. Two frame buildings, each 100 feet long, 25 feet wide, and one story high, were erected by the owner. It was hoped that it would be possible to transfer the material in the shed adjacent to the armory building to the new storage quarters, but this was found to be impracticable, and it was therefore recommended that an additional building be erected between the two existing sheds on Ninth street, and that these two sheds be extended.

Provision has been made in the appropriations for the coming year for the removal of the sheds south of the Smithsonian building. They will probably be rebuilt on the ground leased by the Museum on Ninth street. The need for suitable fire protection for the Museum property stored at this place is urgent.

A number of applications for the use of the lecture hall have been granted during the year. When lectures are given at night, it is necessary that additional watchmen, firemen, and other attendants be provided, and if the lantern is used, a skilled operator is required. The society or association asking the privilege of using the hall, assumes the expense of such additional service. It is also required that information be given in advance as to the names of the lecturers and the subjects of the proposed lectures. It has been found necessary to refuse to permit the removal of the lantern from the Museum building.

The report of the acting chief clerk is accompanied by a statement of the proceedings of Congress during the fiscal year, so far as they concern the Smithsonian Institution and its bureaus.

The report of the property clerk, Mr. J. S. Goldsmith, includes a number of detailed statements showing the work performed during the year, the amount of supplies of various kinds purchased, and the amount on hand June 30, 1897. More than 1,000 invoices of supplies were examined, transferred to official forms, and certified for settlement. One thousand six hundred and thirteen inside requisitions for general supplies, and 1,505 requisitions for stationery were filled; also 74 requisitions for cases, etc.

CORRESPONDENCE AND REPORTS.

There has been a large increase of work in this division, which remains under the charge of Mr. R. I. Geare. This is doubtless due to the now well-established policy of the Museum with regard to supplying technical information to all applicants. There has also been general evidence of increased interest in the publications of the Museum, and this has resulted in a much larger distribution of them than in any previous year.

During the year more than 15,000 official letters and other papers have been prepared, and in addition nearly 30,000 volumes and pamphlets have been sent, free of charge, to applicants for special publications and to the libraries and individuals on the regular mailing lists. The number of individuals making special application for some Museum work is not less than 6,000, and it may be added that, whenever practicable, their requests have been complied with.

The Annual Report for 1894, Volume XVIII of the Proceedings, Bulletins 47 and 49, and Special Bulletins 2 and 3 have been distributed to the institutions on the regular mailing lists of the Museum, as have also the separate papers issued from time to time during the year.

In addition to the letters addressed to the Museum, there are received from the parent Institution not less than 4,000 letters a year, asking not only for publications, but for technical information, which can be supplied only by reference of these letters to members of the Museum scientific force.

The detail, in February, of Mr. J. L. Willige, of this office, to act as chief clerk of the Museum, while undoubtedly serving the best interests of the Museum, was a serious loss to this division, and as no substitute has yet been appointed, his work is kept up only by the strenuous efforts of others in the office, among whom it has been subdivided, in addition to their regular duties. In other respects the force of the office has remained practically the same as last year.

The manuscript and illustrations of the Report for 1895 were completed early in the fiscal year, and during the fall the proof of the administrative portion of the Report was received and read. In February the general editorial supervision of the papers in the appendix to the Report was placed in charge of the editor of the Proceedings and Bulletins. Owing to pressure of other matters in the editor's office, however, it became necessary to detail a clerk from this division for several weeks, to assist in editing the papers and in proof-reading. The administrative part of the Annual Report for 1896 has been prepared in this office, as well as that part of the Secretary's report to the Board of Regents, which relates to the affairs of the National Museum.

Considerable time was spent toward the close of the fiscal year in cataloguing, in convenient form for reference, the applications for specimens received during the past twenty or twenty-five years from educational institutions.

Manuscript was prepared for a pamphlet giving a general description of the exhibits sent by the Museum to the Tennessee Centennial Exposition.

A statement was prepared of the most important Government explorations which resulted in the acquisition of natural history or ethnological material by the Institution or the National Museum.

A beginning was made toward the compilation of statistics showing the size, value of collections, etc., of the principal museums in this country and abroad.

REGISTRATION AND DISTRIBUTION.

During the year 42,583 packages of all kinds were received. Of this number, 611 packages contained specimens for the Museum collections, 1,288 contained supplies of various kinds for the offices and shops, and about 28,000 consisted of publications. There was an increase of more than 17,000 in the total number of incoming packages, about 60 per cent of this increase being due to the unusually large number of publications received. The total number of boxes and packages sent out was 3,332, of which 367 consisted of material shipped to the Tennessee Centennial Exposition.

The entries on the incoming transportation record numbered 3,242, and on the outgoing transportation record 1,613.

There were 1,467 regular accessions, while 716 lots of material were received for identification.

One hundred and ninety packages were placed in storage and 761 were withdrawn.

The number of specimens distributed during the year was 26,712, of which number 3,342 consisted of material lent for study. More than 12,000 herbarium specimens were sent out in exchange, and many sets of marine invertebrates and geological specimens were distributed to educational institutions.

A detailed statement, arranged geographically, showing to what institutions and individuals specimens have been sent during the year, is printed as Appendix IX. The following statement, arranged geographically, shows the number of lots of specimens sent out:

United States:		United States—Continued.	
Alabama	1	Kentucky	1
Arizona	1	Maine	1
California	14	Maryland	4
Colorado	2	Massachusetts	31
Connecticut	6	Michigan	2
Delaware	3	Minnesota	1
District of Columbia	15	Missouri	8
Florida	2	Nebraska	3
Georgia	2	New Jersey	6
Illinois	12	New York	33
Indiana	5	North Carolina	1
Iowa	11	Ohio	3

United States—Continued.		Foreign countries—Continued.	
Oregon	1	Canada	8
Pennsylvania	24	China	1
South Carolina	1	Costa Rica	1
South Dakota	1	Denmark	1
Tennessee	1	England	11
Utah	4	France	4
Vermont	2	Germany	7
Virginia	3	Italy	5
Wisconsin	2	Mexico	1
Wyoming	3	Russia	1
Foreign countries:		Scotland	1
Africa	1	Spain	1
Australia	3	Switzerland	2
Austria	3	Turkey	1
Bermuda	1		
Brazil	1	Total	264

The various departments of the Museum have distributed material as gifts or in exchange as follows:

Mammals	38	Minerals	177
Birds	449	Geology	2,430
Reptiles	3	Ethnology	103
Fishes	110	Prehistoric anthropology	377
Mollusks	227	Technology	1
Insects	1,642	Musical instruments	8
Marine invertebrates	3,754		
Fossils	1,602	Total	23,370
Plants	12,449		

BUILDINGS AND SUPERINTENDENCE.

Mr. Henry Horan, who had been connected with the Smithsonian Institution and the National Museum for many years, and who since 1880 had held the position of superintendent of buildings, died on September 29, 1896. On October 20 a new division was organized—that of buildings and superintendence—with Mr. J. Elfreth Watkins as chief. The following subdivisions are included: Cases and fixtures, J. S. Goldsmith, property clerk, in charge; buildings, watch-service, mechanics and labor, C. A. Steuart, general foreman; heating, lighting, and electrical service, J. H. Parkhurst, engineer.

Much-needed repairs and improvements have been made on both the Smithsonian and the Museum buildings, although on account of lack of funds it was necessary to restrict operations in this respect to such changes as were absolutely essential.

During the winter and spring the attention of the office was taken up to a considerable extent with matters connected with the erection of galleries in the Museum building. The contract for the ironwork was awarded February 24, at a cost of $3,200, the work to be completed in sixty days. The contract for the stairs and balustrades was awarded on May 13, at a cost of $1,780, and that for the fireproof arching and floors on June 29, at a cost of $2,214.

On December 19, 1896, it was possible, for the first time in the history of the Museum, to open all the courts of the building to the public.

The watchmen have been trained in the use of the fire extinguishers, and regular fire drills were held. One of the watchmen rendered efficient assistance at a fire in the storage rooms on Ninth street, and as a result much valuable property was saved. The watchmen were also trained in the use of the telephone exchange board. There were more than 28,000 telephone calls during the year.

The Smithsonian and Museum buildings were illuminated on the evening of March 4, the date of the inauguration of President McKinley.

Three hundred and ninety requisitions relating to repairs to buildings have been attended to by the general foreman; 274 for making and repairing cases have been looked after by the property clerk, and 54 have been attended to by the engineer.

The report submitted by the chief of the division includes detailed statements showing the number of requisitions received from each of the departments of the Museum, the amount of fuel, gas, and ice consumed, the temperature in the halls of the Museum during each day of the winter months, the supplies purchased for the use of the division, and an itemized list of the requisitions completed. The last-mentioned statement shows that 41 cases were constructed, 26 altered or remodeled, 38 repaired, 61 painted, and 49 glazed. There were 672 unit drawers made and 1,043 repaired or fitted to cases.

WORK OF THE MUSEUM PREPARATORS.

TAXIDERMISTS.

Mr. William Palmer, chief taxidermist, reports that 65 mammals were received and skinned during the year. About one-half of these came from the National Zoological Park, as shown in the following table:

Mammals received in the flesh.	From the Zoological Park.	From other sources.
Primates	6	1
Carnivora	21	3
Ungulata	1	.....
Chiroptera	.....	7
Rodentia	3	21
Insectivora	.....	1
Marsupialia	1	.....
Total	32	33

The bodies of many of these specimens were sent to the Bureau of Animal Industry, Department of Agriculture.

Twenty-five specimens of mammals, birds, and reptiles, in addition

to the above, were immediately turned over to other departments of the Museum.

A number of skins were received to be remade, as follows:

Skins received.

Primates	4	Rodentia	30
Carnivora	14	Insectivora	2
Ungulata	8		
Chiroptera	3	Total	61

There were thirty-one skins received for poisoning, cleaning, or drying.

The following table shows the number of dry skins made up:

Skins made up for the study series.

Primates	19	Rodentia	53
Carnivora	52	Marsupialia	1
Ungulata	28		
Chiroptera	7	Total	161
Insectivora	1		

In addition, twenty-nine skins were reshaped and dried, and two heads of deer were poisoned.

Twenty-six skins were returned to the Department of Agriculture during the year.

The number of specimens mounted is as follows:

Mammals mounted.

Primates	4	Chiroptera	4
Carnivora	6	Insectivora	2
Ungulata	1		
Rodentia	15	Total	32

About three months were spent on work for the Tennessee Centennial Exposition. For this purpose four specimens of lemurs were mounted and eighteen other specimens cleaned and packed; a cast of a large Galapagos tortoise was made and painted; three casts of cetaceans were made; a cast of the head of a large turtle was cleaned and placed on a new shield; a model of the National Zoological Park was finished and packed; a group of monkeys and another of gibbons was renovated and put into condition for exhibition, and models of a giant squid and an octopus received similar attention. Mr. Palmer devoted three weeks' time to the work of setting up this and other exhibits at the Exposition.

About 200 pair of elk, caribou, and moose antlers, which have been accumulating in the Museum for many years, were turned over to the taxidermist for attention. It was decided to select a series to mount upon shields for decorating the piers of the mammal hall. Those having skulls were cleaned and bleached. The bases of the others were built up and covered with brown velvet. Twenty-seven sets were thus prepared and hung on piers.

Other work has been attended to as follows: Four mounted heads of

American bison were repaired, poisoned, placed on new shields, and installed in the department of mammals; six mounted heads of mammals were overhauled and boxed for shipment; a number of casts of an Assyrian cylinder seal were made; several mounted heads on the south wall of the exhibition hall devoted to the department of mammals were taken down, cleaned, and rehung.

The following statement shows the number of skins on hand June 30, 1897:

Primates	7	Sirenia	1
Carnivora	149	Marsupialia	14
Ungulata	104		
Chiroptera	5	Total	312
Rodentia	32		

In the department of birds the work of the preceding years—that of renovating the entire series of mounted birds—was continued. A number of specimens received in the flesh were cleaned and prepared, other skins were poisoned, and a few improperly made specimens were remade. A limited number of mounted specimens were transferred to modern stands and a few mounted specimens were made up for the study series. The Museum specimen of the extinct Philips Island parrot was remounted. A series of 49 specimens of birds from British Guiana and about 35 parrots were mounted for the Tennessee Centennial Exposition. A group of 3 Argus pheasants was mounted and nearly completed.

OSTEOLOGISTS.

Considerable time has been spent in cleaning fishes and the contents of the stomachs of seals, the synoptic series has received attention, and a number of casts of brains have been made. Many vertebrate fossils have been mounted and repaired. Material was prepared, mounted, and boxed for the Tennessee Centennial Exposition.

The work of laying a new floor in the exhibition hall of the department of comparative anatomy necessitated a large amount of extra labor in removing the specimens, placing some of the material in storage, and finally in cleaning and preparing the specimens for exhibition after the work on the floor had been finished.

A summary of the osteological work during the year is presented in the following statement:

	Mammals.	Birds.	Reptiles.	Crustaceans.	Total.
Skeletons received in the flesh	3	2	3		8
Skeletons cleaned	1	17			18
Parts of skeletons cleaned	53	13			66
Skulls cleaned	883	3			886
Specimens mounted		1	2	1	4
Total	940	36	5	1	982

Of the skulls cleaned, more than 500 were for the Department of Agriculture.

PHOTOGRAPHER.

Mr. T. W. Smillie reports that the following work has been accomplished in the photographic laboratory: Seven hundred and thirty-three negatives have been made; also 1,318 platinum prints, 50 silver prints, 1,100 cyanotypes, 6 bromide enlargements, and 41 lantern slides.

The free public lectures in the Museum have, as usual, been illustrated under the direction of the photographer, and Mr. Smillie has served as chairman of the Board on Photography of the United States Civil Service Commission.

COLORIST.

The work of Mr. A. Zeno Shindler on the series of paintings representing the races of man has been continued. Five paintings were completed during the year and two more are nearly finished. Fifty-nine paintings belonging to the Catlin collection were cleaned or restored. This work requires a great deal of time and much care. The hands, heads, and feet of several lay figures were painted, also a number of casts of fishes and reptiles.

APPENDIX I.

THE SCIENTIFIC AND ADMINISTRATIVE STAFF.

[Corrected to June 30, 1897.]

S. P. Langley, Secretary of the Smithsonian Institution, Keeper, Ex-Officio.

G. Brown Goode,[1] Assistant Secretary of the Smithsonian Institution, in charge of the U. S. National Museum.

Frederick W. True, Executive Curator.

SCIENTIFIC STAFF.

ARTS AND INDUSTRIES:

Historical Collections: A. Howard Clark, Custodian.

Religious Ceremonial Objects: Cyrus Adler, Custodian.

Technological Collections: J. E. Watkins, Curator.

Electrical Collections, George C. Maynard, Custodian.

Graphic Arts: S. R. Koehler, Curator.

Materia Medica: J. M. Flint, United States Navy, Honorary Curator.

Forestry: B. E. Fernow, Honorary Curator.

Physical Apparatus: W. C. Winlock, Honorary Curator (died September 20, 1896).

Photographic Collections: T. W. Smillie, Custodian.

ETHNOLOGY: O. T. Mason, Curator; Walter Hough, Assistant Curator.

Aboriginal Pottery: William H. Holmes, Honorary Curator.

Pueblo Collections: F. H. Cushing, Custodian.

ORIENTAL ANTIQUITIES: Paul Haupt, Honorary Curator; Cyrus Adler, Honorary Assistant Curator; I. M. Casanowicz, Aid.

PREHISTORIC ANTHROPOLOGY: Thomas Wilson, Curator.

MAMMALS: Frederick W. True, Curator.

BIRDS: Robert Ridgway, Curator; C. W. Richmond, Assistant Curator.

BIRDS' EGGS: Charles Bendire, Honorary Curator (died February 4, 1897).

REPTILES AND BATRACHIANS: Leonhard Stejneger, Curator.

FISHES: Tarleton H. Bean, Honorary Curator; Barton A. Bean, Assistant Curator.

MOLLUSKS: William H. Dall, Honorary Curator; C. T. Simpson, Aid; W. B. Marshall, Aid.

INSECTS: L. O. Howard, Honorary Curator; W. H. Ashmead, Custodian of the Collection of Hymenoptera; D. W. Coquillett, Custodian of the Collection of Diptera; O. F. Cook, Custodian of the Collection of Myriapoda; E. A. Schwarz, Custodian of the Collection of Coleopterous Larvæ; Martin L. Linell, Aid (died May 3, 1897).

MARINE INVERTEBRATES: Richard Rathbun, Honorary Curator; J. E. Benedict and Miss M. J. Rathbun, Assistant Curators.

Helminthological Collections: C. W. Stiles, Custodian.

COMPARATIVE ANATOMY: Frederic A. Lucas, Curator; Frank Baker, Associate Curator (Honorary).

PLANTS (NATIONAL HERBARIUM): F. V. Coville, Honorary Curator; J. N. Rose, C. L. Pollard, and O. F. Cook, Assistant Curators; Miss Carrie Harrison, Aid.

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[1] Dr. G. Brown Goode died September 6, 1896, and on January 27, 1897, Mr. C. D. Walcott was appointed Acting Assistant Secretary.

PALEONTOLOGY: C. D. Walcott, Honorary Curator; Charles Schuchert, Assistant Curator.

Vertebrate Fossils: O. C. Marsh, Honorary Curator; F. A. Lucas, Acting Assistant Curator.

Invertebrate Fossils:

Paleozoic: Charles Schuchert, Custodian.

Mesozoic: T. W. Stanton, Custodian.

Cenozoic: W. H. Dall, Associate Curator (Honorary).

Fossil Plants: Lester F. Ward, Associate Curator (Honorary); F. H. Knowlton, Custodian of Mesozoic Plants; David White, Custodian of Paleozoic Plants.

MINERALS: F. W. Clarke, Honorary Curator; Wirt Tassin, Assistant Curator.

Collection of Gems and Precious Stones: Rev. Dr. L. T. Chamberlain, Custodian.

GEOLOGY: George P. Merrill, Curator; W. H. Newhall, Aid.

LIBRARY: Cyrus Adler, Librarian (Honorary); Newton P. Scudder, Assistant Librarian.

ASSOCIATES.

(Honorary.)

Theodore Gill, Associate in Zoology.

R. E. C. Stearns, Associate in Zoology.

R. W. Shufeldt, Associate in Comparative Anatomy.

C. A. White, Associate in Paleontology.

C. Hart Merriam, Associate in Zoology.

ADMINISTRATIVE STAFF.

CHIEF CLERK: W. V. Cox.

CHIEFS OF DIVISION:

Correspondence and Reports: R. I. Geare.

Registration and Storage: S. C. Brown.

Editor of Proceedings and Bulletins: Marcus Benjamin.

Disbursing Clerk: W. W. Karr.

Property Clerk: J. S. Goldsmith.

Photographer: T. W. Smillie.

Buildings and Superintendence: J. E. Watkins.

PREPARATORS.

Joseph Palmer, Chief Modeler.

William Palmer, Chief Taxidermist.

A. Z. Shindler, Preparator.

J. W. Scollick, Osteologist.

Henry Marshall, Taxidermist.

N. R. Wood, Preparator.

A. H. Forney, Taxidermist.

APPENDIX II.

List of Accessions during the Year ending June 30, 1897.

[All accessions marked with an "N" indicate material obtained primarily for exhibition at the Nashville Exposition.]

Abbott, Dr. William L., Philadelphia, Pennsylvania: Two very large and valuable collections of natural-history specimens from Trong, Lower Siam, consisting of mammal skins, birds' skins, birds' eggs and nests, reptiles, skeletons of reptiles, fresh-water shells, marine invertebrates, insects representing all orders, ethnological objects, and musical instruments. (31341, 31941.)

Abel, J. C., Lancaster, Pennsylvania: Stone implements and archæological objects collected near Lancaster. (30983, 31236, 31656, 31858, 31957, 32023, 32081.)

Acker, Dr. C. S., Arkansas City, Kansas: Photograph of a clay urn taken from a mound near Arkansas City. 31600.

Adams, F. D., McGill University, Montreal, Canada: Geological material (30955); nepheline syenite and sodalite from Canada (31880). Exchange.

d'Adelung, Dr. N. (See under Geneva, Switzerland: Musée d'Histoire Naturelle.)

Adler, Dr. Cyrus, Smithsonian Institution: Set of 11 Turkish weights obtained in Constantinople (30910); 10 campaign letters of 1896 (32077).

Agriculture, Department of, Hon. J. Sterling Morton, Secretary: Type specimen of *Eugnorista occidentalis* Coquillett, collected by Prof. T. D. A. Cockerell, Las Cruces, New Mexico (31144); 160 specimens of Acridiidæ and a few other insects, collected in Sacramento Mountains, New Mexico, by Mr. C. H. Tyler Townsend (31244); 15 specimens of miscellaneous insects, collected by F. F. Crevecœur, Onaga, Kansas (31389); 85 species of miscellaneous insects, collected by Mr. Crevecœur (31738); about 600 examples of Homoptera, Micro-hymenoptera, and Coccinellidæ, collected by A. Koebele in China, Japan, and Australia (31926); small collection of fishes made by Messrs. Nelson and Goldman in Mexico, consisting of 8 species, including a new cyprinodont, and 23 very fine specimens of *Anableps dowi* (31917); branch of Yucca, dried fruit of Yucca, and boiled Salvia seed (32073); 2 species of *Bulimulus* from Mexico (32088); land and fresh-water shells from Mexico and Alaska (32181); specimens of *Hylurgops nigripennis* Mann; *Amara erratica* Sturm; *Homalomyia canicularis* Meigen, from Kadiak Island, Alaska, and a specimen of *Physonota limoniata* Boh., from near San Sebastian, Mexico (32196).

Material deposited in the National Herbarium: 163 plants from Oregon, collected by J. B. Leiberg (30836); 257 dried plants, received from Aven Nelson, Laramie, Wyoming (30837); 7 herbarium specimens (30840); herbarium specimen, received from Mrs. W. W. Thompson, Smithville, Georgia (30841); herbarium specimen and tubers, sent by A. J. Tisdall, Bell Ranch, New Mexico (30842); 3 plants from California, sent by Dr. A. Davidson, Los Angeles (30843); 200 plants, collected by J. B. Leiberg in Oregon (30988); 625 dried plants from Mexico, collected by Edward Palmer (31229); 30 specimens of *Junci*, collected by P. A. Rydberg, Columbia College, New York (31370); 15 specimens of dried plants, collected by N. L. Gardner, Coupeville, Washington (31417); 904 specimens of dried

AGRICULTURE, DEPARTMENT OF—Cont'd. plants, collected by J. B. Leiberg in Oregon (31460); plant sent by J. A. Flath, Glenbeulah, Wisconsin (31485); specimen of *Juncus polycephalus*, from Dr. Charles Mohr, Mobile, Alabama (31531); specimen of *Picea rubra*, from Roan Mountain, North Carolina (31533); 109 plants, collected by C. H. Tyler Townsend, Las Cruces, New Mexico (31553); 3 plants from the District of Columbia, collected by F. L. J. Boetcher (31626); 6 specimens of dried plants, sent by J. W. Tomey (31679); 37 plants from Oregon, collected by J. B. Leiberg (31681); specimen of *Juncus differsissimus*, sent by C. Mohr, Mobile, Alabama (31695); specimen of *Peperomia* (31746); 31 herbarium specimens, sent by Robert M. Horner (31811); plants from Leland Stanford Junior University, California, collected by W. R. Dudley (31853); plant from Texas, sent by George Stotley (32127); specimen of *Juniperus sabinoides*, collected in Texas by H. T. Fuchs (32135); specimen of *Pinus divaricata*, collected in New York by Prof. G. K. Gilbert (32192).

AIKEN, C. E., Colorado Springs, Colorado: Aiken's Screech Owl, *Megascops asio aikeni*. Purchase. 31946.

ALBANY MUSEUM. (See under Grahamstown, South Africa.)

ALDRICH, Hon. T. H., House of Representatives: Rock phosphate; weathered phosphatic shale, showing zonal structure. Transmitted by the U. S. Geological Survey. 31659.

ALDRICH, CHARLES. (See under D. T. Stanley.)

ALLEN, CHARLES A., San Geronimo, California: Three nests of Hutton's Vireo and a snake from California (31058); mammal skins and skulls, comprising 2 specimens of *Microtus*, 2 of *Sorex*, 2 of *Peromyscus*, and 1 of *Mus musculus* (31879).

ALLEN, Dr. H. N. (See under W. W. Rockhill.)

AMATEIS, L. (See under L. Menchini.)

AMERICAN ARCHÆOLOGICAL AND ASIATIC ASSOCIATION, transmitted by Gen. G. W. Bailey, Nevada, Iowa: Clay vessel with an ornament representing a human head on the rim, found in a mound in Marshall County. 31632.

AMERICAN ELECTRICAL WORKS, Providence, Rhode Island: One specimen of lead-covered telephone cable, composed of 240 wires. 31548.

AMHERST COLLEGE OBSERVATORY, Amherst, Massachusetts, transmitted by Prof. David P. Todd: Two frames containing photographs illustrating the work of the Amherst Eclipse Expedition to Japan during the summer of 1896. 31985.

ANDERSON, R. M., Forest City, Iowa: Specimen of Krider's Hawk. 30869.

ANDREWS, Dr. E. A., Johns Hopkins University, Baltimore, Maryland: Crabs from Green Turtle Cay, Bahamas, representing 17 species. 32133.

ANDREWS, J. O., Gainesville, Florida: Piece of a branch, with thorns and leaves of a tree, and fruit of the same. 31099.

ANDRUS, F. H., Elkton, Oregon: Land and fresh-water shells representing 10 species (30930); specimens of Pupa (31328); land-shells (31596).

ANTHONY, A. W., San Diego, California: Fishes, land-shells, crustaceans, reptiles, birds' eggs and a nest (all new to the collection and to science), and deer antlers from Lower California (purchase) (31199); birds' eggs from the same locality (purchase) (31382); 22 birds' skins, representing 4 species from islands off the coast of Lower California (exchange) (31324); 8 birds' skins from the same locality (gift) (31325); 80 plants (purchase) (31535); type specimens of 3 species of birds from Lower California (deposit) (31667).

ANTHONY, H. R., Reading, Pennsylvania: Call-bell in use at the Marshall House, Alexandria, Virginia, in 1861, when Colonel Ellsworth was shot. Deposit. 32114.[1]

APPLEGATE, E. I., Klamath Falls, Oregon: Eight specimens of dried plants (gift) (31331); 92 plants (purchase) (31345); 52 specimens of Phanerogams (gift) (31654); specimen of *Orthocarpus* (gift)

[1] Received in a previous fiscal year.

Applegate, E. I.—Continued.
(31972); plant (gift) (31997); 40 specimens of dried plants from the vicinity of Crater Lake, Oregon (gift) (31999).

Appleton, J. M., Dayton, Ohio: Portrait study. 31007.

Arnheim, J. S., San Francisco, California: Shells from various localities (32104); land, fresh-water, and marine shells from the western coast of North America and other localities, representing 23 species (31197); 2 land crabs from Clipperton Island (31674); land, fresh-water, and marine shells from various localities, representing 30 species (31884); shells from Esquimalt Dry Dock, Victoria, Vancouver Island (32248).

Ashmead, W. H. (See under W. Hague Harrington.)

Ashmun, Rev. E. H., Albuquerque, New Mexico: Collection of land and fresh-water shells from New Mexico, Arizona, and Nebraska. (30888, 31179, 31279.)

Attwater, H. P., San Antonio, Texas: Forty-three birds' eggs, representing 8 species, 2 birds' nests (gift) (31077); 11 birds' skins from Texas (purchase) (31114); 2 specimens of *Tradescantia* (gift) (31890).

Austin, Mrs. R. M., Quincy, California: Six hundred specimens of dried plants. Purchase. 31994.

Australian Museum. (See under Sydney, New South Wales:)

Avondale Marble Company, Avondale, Pennsylvania: Specimen of marble. 31587.

Ayers, George, Alexandria, Virginia, transmitted by Mr. Entwistle: Specimens of Brunnich's Murre, *Uria lomvia*, in the flesh, from the Potomac River. 31461.

Bailey, Gen. G. W. (See under American Archæological and Asiatic Association.)

Baker, Carl F., Fort Collins, Colorado: Eight specimens of Colorado Umbelliferæ. 31723.

Baker, Dr. Fred., San Diego, California: Marine shells from San Diego Bay. 31614.

Baker, Frank C. (See under Chicago Academy of Sciences.)

Baker, Marcus. (See under Smithsonian Institution, Bureau of Ethnology.)

Baker, R. T., Sydney, New South Wales: Specimens of dried plants (gift) (31101); (exchange) (31163; 31212).

Baker University, Baldwin, Kansas, transmitted by C. S. Parmenter: Thirty-two specimens of insects. 31515.

Banner, W. H., York, Pennsylvania: Two historical war pictures. Purchase. 32161.

Barbour, Prof. E. H. (See under Nebraska, University of).

Barcelona, Spain: Royal Academy of Science and Arts, transmitted by Señor Arturo Bofill, secretary: Ten specimens of Mesozoic fossils, minerals, and shells. Exchange. 31226.

Barlow, Chester, Santa Clara, California: Nest and 4 eggs of White-tailed Kite, *Elanus leucurus*. 30858.

Barnes, A. J., Dunedin, Florida: Marine shells from Florida representing 3 species. 31974.

Barrett-Hamilton, G. E. H., Kilmannock, New Ross, Leinster, Ireland: Insects from the Pribilof Islands. 31335.

Bartlett, Mrs. N. Gray, Chicago, Illinois: Photograph—"A Reverie." 31006.

Bartsch, Paul, U. S. National Museum: Four specimens of *Viola* (gift) (31708); 4 plants (gift) (31790); specimen of *Lycosa nidifex* Marx, with nest (gift) (31906); 2 salamanders from the District of Columbia (collected for the National Museum) (32152); 2 snakes and a frog (collected for the National Museum) (32252); crabs from Smiths Island, Virginia, representing 2 species (collected for the National Museum) (32269); leech from Virginia (collected for the National Museum) (32286).

Bascom, Dr. Florence. (See under Bryn Mawr College.)

Batalin, Alex., St. Petersburg, Russia: 696 specimens of dried plants from Brazil and other localities. Exchange. 31126.

Bates, J. M., Long Pine, Nebraska: Two specimens of fungi. 31419.

Beadle, C. H. (See under Biltmore Herbarium.)

Bean, Dr. T. H., Battery Park Aquarium, New York City: Alcoholic beetles, collected by William J. Fisher on the island of Kadiak, Alaska. 30931.

Beck, R. H., Berryessa, California: Twenty-three birds' skins. 31476.

Beckers, Alex., Hoboken, New Jersey: An adjustable Becker's stereoscope. 32191.

Beckett, W. H., Woodbury, New Jersey: Arrow and spear heads, a grooved ax, and fragments of pottery. 31992.

Beckwith, Paul, U. S. National Museum: Ten-cent fractional currency of the issue of 1874 (32195); ten-barreled revolver, used during the war of the rebellion (32261).

Beecher, Dr. C. E., Yale Museum, New Haven, Connecticut: Six fine specimens of *Echinocaris costalis* Beecher; 2 specimens of *Tropidocaris bicarinata* Beecher, 16 specimens of *Nucula corbuliformis*, and 3 specimens of *Lingula* (31455); 2 models of *Triarthrus becki*, showing the limbs (31570); model of a Trilobite, with appendages (31616).

Bendire, Maj. Charles, U. S. A. (See under George Griffin, A. Hewitt, Dr. J. C. Merrill, R. S. Williams.)

Benedict, J. E., U. S. National Museum: Specimen of *Scalops aquaticus* from Woodside, Maryland (gift) (30846); Chimney Swift, *Chætura pelagica*, in the flesh (gift) (31147); 4 salamanders from Nashville, Tennessee (collected for the National Museum) (32158). (See under J. D. Mitchell.)

Benedict, J. E. jr., Woodside, Maryland: Devonian specimen of *Stropheodonta*. Exchange. 31676.

Benners, G. B., Philadelphia, Pennsylvania: Four sets of birds' eggs and 2 nests from Comal County, Texas. Exchange. 31283.

Benson, H. W., Kelseyville, California: Concretions from Lake County, California. 31551.

Benton, Frank, Department of Agriculture: Young pea-fowl, in the flesh. 31340.

Berckman, P. J., Augusta, Georgia: One hundred bulbs of *Hymenocallis*. Purchase. 31135.

Berlin, Germany:

Botanical Museum: 476 plants from Argentine Republic and 517 plants principally from Brazil (exchange) (31707); three fragments of *Angelica mexicana* (31751).

Berlin, Germany—Continued.

Royal Museum of Natural History, transmitted by Prof. O. F. Cook: Myriopods belonging to the Family Craspedosomatidæ. 31339.

Royal Zoological Museum: Crabs, representing 32 species (31481); transmitted by Dr. Paul Matschie; specimen of *Monophyllus redmanni*. (31607.) (Exchange.)

Bernard, Dr. F., Paris, France: Type specimens of *Condylocardia* and *Hochstetteria* from southern seas. 31337.

Bethel, E., Denver, Colorado: Nine herbarium specimens. 31106.

Betteswortii, G. W., Omaha, Nebraska: Four photographic views, a publication entitled "An Omaha Idea," and 3 fragments of pottery (31988); photograph of a stone ax and fragments of pottery found in the ash strata near Omaha (32065).

Beyer, Dr. G. E., Tulane University, New Orleans, Louisiana: Plaster cast of a fragment of pottery representing an animal's head (31608); plaster casts of a human skull and of pieces of pottery (32101); plaster cast of a hematite plummet (32282).

Bibbins, Arthur, The Woman's College, Baltimore, Maryland: Specimen of wavellite from Mount Holly Springs, Pennsylvania. 31663.

Biederman, C. R., Gold Hill, Oregon: Slung shot found in Placer Mine, near Rogue River; collection of double-terminated crystals from Sierra Blanca, New Mexico, and petrified wood from near Gold Hill. 32149. (See under Prof. J. W. Meritt.)

Bierstadt, E., New York City: Two frames containing pictures of rugs, illustrating the progress of color printing from gelatine plates. 31090.

Biltmore Herbarium, Biltmore, North Carolina, transmitted by C. D. Beadle, Curator: Five hundred plants (exchange) (31818); 3 specimens of *Trillium* (gift) (32238).

Biscoe, H. L., New York City: Collection of badges worn at the Sixth Reunion of the Ex-Confederate Veterans, Richmond, Virginia. 30928.

Black, William, Dale, Idaho, transmitted by R. L. Packard: Leaf-shaped

BLACK, WILLIAM—Continued.
chipped implement from Washington County. 31047.

BLAIR, HERBERT B., U. S. Geological Survey: Tooth of *Mastodon obscurus* 31646.

BLAIR, R. A., Sedalia, Missouri: Specimen of Devonian limestone. 31736.

BLANKINSHIP, J. W., Cambridge, Massachusetts: Twenty botanical specimens from California. 31873.

BLATCHLEY, W. S., State Geologist of Indiana, transmitted by the Bureau of Ethnology, Smithsonian Institution: Small piece of stalagmite from Wyandotte Cave, Indiana. 31641.

BLUNCK, A. E., Johnstown, New York: Bantam game-cock and a brown Leghorn hen. 31584.

BOARDMAN, G. A., Calais, Maine: Five eggs of Passenger Pigeon, *Ectopistes migratorius*. 31261.

BOETTCHER, F. L. J., Washington, District of Columbia: One hundred and one dried plants from northwestern Germany. Exchange. 31105. (See under Agriculture, Department of.)

BOFILL, Señor ARTURO. (See under Barcelona, Spain: Royal Academy of Science and Arts.)

BOGAN, R., New South Wales, Australia: Specimen of *Rhagodia parabolica* R. Br. 31434.

BOLLES, Mrs. C. C., Washington, District of Columbia: Golden mat from Polynesia. Purchase. 30866.

BOLTON, Prof. H. Carrington, Washington, District of Columbia: Violin and case from Paris. 31631.

BOSCOE, J. F., Hembrie, Texas: Twenty-one plants. 31346.

BOTANIC GARDENS. (See under Calcutta, India.)

BOTANICAL MUSEUM. (See under Berlin, Germany.)

BOUCARD, A., Oak Hill, Spring Vale, Isle of Wight, England: Specimen of the rare *Leipoa ocellata* from Australia (31555); photograph of Mr. Boucard (31634).

BOURKE, Mrs. J. G., Omaha, Nebraska: One hundred and two stereoscopic photographs of Indians and scenery, and 7 photographs of Indians. 31963.

BOUVIER, Prof. E. L. (See under Paris, France: Museum of Natural History.)

BOWMAN, D. A., Bakersville, North Carolina: Minerals. 31187.

BOYD, C. R., Wytheville, Virginia: Specimen of spinel. Purchase. 31586.

BOYLE, Dr. C. B., Hot Springs, South Dakota: Asbestos from Lawrence County, South Dakota. 31017.

BRANDT, Dr. K. (See under Kiel, Germany: Zoological Institute.)

BRANICKI MUSEUM. (See under Varsovie, Russia.)

BRAVERMAN, M., Visalia, California: Specimens of magnesite from Tulare County, California. 32212.

BRENINGER, G. F., Enterprise, California: Titmouse. 31463.

BRENSING, HERMANN, San Antonio, Texas: Specimen of Twig-girdler Beetle, *Oncideres texana* Horn. 32129.

BRETON, Miss ADELA, Camden Crescent, Bath, England: Three chipped stone implements from Zacatecas and San Juan del Teul, Mexico. 31915.

BREWER, W. H New Haven, Connecticut: Plants from California. 30877.

BREWSTER, WILLIAM, Cambridge, Massachusetts: Specimen of Cairnes's Warbler, *Dendroica cærulescens cairnsi*, from Virginia. 31603.

BRICK, Dr. C., Hamburg, Germany: Three hundred and seventy-one dried plants from Australia, Africa, and Europe. Exchange. 31117.

BRIGGS, A. A., Clear Lake, Wisconsin: Plants. (30975, 31039, 31100, 31141, 31332.)

BRIMLEY, C. S., Raleigh, North Carolina: Specimens of *Neonympha eurytris* Fabr., *Neonympha gemma* Hbn., and *Neonympha sosybius* Fabr. (30964); 9 butterflies belonging to the family Hesperidæ (31000).

BRIMLEY, H. H. & C. S., Raleigh, North Carolina: Snakes from Florida and North Carolina. (31924, 31546, 31728). Purchase.

BRITISH MUSEUM. (See under London, England.)

BRITTON, Dr. N. L., Columbia University, New York: Specimen of *Chrysoplenium alternifolium*. 31709.

BRITTS, Dr. J. H., Clinton, Missouri: Seven specimens of *Promacrus nasutus*

BRITTS, Dr. J. H.—Continued.
Meek. (gift) (31380); type specimens of fossil plants (exchange) (31528).

BRODERS, A. C., Garfield, Virginia: Rude notched implement from Fairfax County. 31045.

BRODIE, JAMES, Biloxi, Mississippi: Two fragments of pottery and a copper sinker found on Big Ridge, near Biloxi, and a specimen of *Granatocrinus*, a blastoid from the Lower Carboniferous, 10 miles north of Huntsville, Alabama. 32219.

BRODNAX, B. H., Brodnax, Louisiana: Wood covered with fungus. 31149.

BROOKS, A. H., U. S. Geological Survey: Five specimens of Hamilton fossils from Cornwall, Orange County, New York. 32012.

BROWN, C. F., Hot Springs, Arkansas: Specimen of quartz. 31968.

BROWN, C. S., Memphis, Tennessee: Two hundred and eighteen plants from the Azores. Purchase. 30891.

BROWN, E. J., Washington, District of Columbia: Birds' skins and birds' eggs. (31201, 31559).

BROWN, GLENN, Washington, District of Columbia: Orbicular granite from Stokes County, North Carolina. 31388.

BROWN, H. E., Clear Creek, California: Ninety-one plants from Oregon and California. Purchase. 31854.

BROWN, LINCOLN, Woodside, Maryland: Sixteen specimens of *Cambarus bartoni*. 30942.

BROWN, Mrs. M. E., New York City: Two rattles made of tinned plate and small wire rings obtained from the western coast of Africa (gift) (31612); 5 mounted and 2 unmounted photographs of persons with musical instruments and a photograph of a portable organ, probably the Nimfali (gift) (31791); a bell from Japan, bell used by the Buddhist priests in worship, and a bell used by Shinto priests in worship (exchange) (32008).

BROWN, Mrs. N. M. (See under E. W. Nelson.)

BROWNLOW, Hon. W. P., House of Representatives: Specimen of Ant-eater, *Cycloturus* (gift) (31604); birds' skins and eggs and a nest from British Honduras (31605).

BRUNTON, D. W., Aspen, Colorado: Three specimens of polybasite. 31613.

BRYANT, E. S., Minot and Grand Harbor, North Dakota: Skin of White-rumped Sandpiper, *Tringa fuscicollis* (gift) (32103); birds' eggs and a nest (31069).

BRYANT, H. G., Philadelphia, Pennsylvania: Geological specimens from Greenland (gift) (31832); 14 ethnological objects from Inglefield Gulf, Greenland (exchange) (32010).

BRYANT, O., Longwood, Florida: Living Unionidæ. 31911.

BRYN MAWR COLLEGE, Bryn Mawr, Pennsylvania, transmitted by Dr. Florence Bascom: Geological material from South Mountain, Pennsylvania. Exchange. 31713.

BUFFORD, HENRY. (See under Interior Department: U. S. Geological Survey.)

BURGER, W. C., Blacks, California, transmitted by Hon. S. G. Hilborn: Tooth of a fossil elephant. 31412.

BURNS, W. R., Concord, Kentucky: Autograph letter of Thomas Jefferson to George Otis, dated July 18, 1820. 32031.

BURTCH, VERDI, Penn Yan, New York: Fresh-water shells (31242); specimens of *Viripara contectoides*, showing variation of color bands (31261); Unios from Niagara Falls representing 3 species (31445); Unios from the United States representing 6 species (31468); Unionidæ from the eastern section of the United States representing 3 species (31574); Unionidæ from the eastern section of the United States representing 5 species (31669).

BUSH, B. F., Courtney, Missouri: Land and fresh-water shells from Missouri, representing 20 species (gift) (31429); botanical specimens (purchase) (31429, 31765, 31798, 31829, 31836).

BUZZARD, S. S., Berkeley Springs, West Virginia: Sample of maple wood with natural ingrafting. 31554.

CALCUTTA, INDIA: Botanic Gardens: 409 herbarium specimens (31213); 326 botanical specimens (31842). Exchange.

CALIFORNIA ACADEMY OF SCIENCES, Sna Francisco, California, transmitted by L. M. Loomis: Twelve birds' skins (exchange) (31198); 4 type specimens of plants (gift) (31532); transmitted by Dr. J. G. Cooper, shells, from various localities, representing 7 species (gift) (32032).

CALKINS, Lieut. C. G., U. S. N., Nagasaki, Japan: Collection of Chinese industrial and artistic ware made from bamboo, and 9 musical instruments. Purchased for the Museum. 31289.

CALL, Prof. R. ELLSWORTH, Lawrenceburg, Indiana: Type specimens, representing 5 species of Arachnida and a mollusk from Mammoth Cave. 31943.

CAMPBELL, M. R., U. S. Geological Survey: Weathered conglomerate from Virginia. Purchase. 32143.

CANBY, W. M., Wilmington, Delaware: Specimens of *Tiedemannia*. (31725) (lent and returned), (31743) (exchange).

CANTERBURY MUSEUM. (See under Christchurch, New Zealand.)

CANTWELL, G. G., Howkan, Alaska: Four birds' skins. 31711.

CARPENTER, Capt. W. L., U. S. A., Sacketts Harbor, New York: Nest, 4 eggs, and skin of Prairie Horned Lark. 32244.

CARR, J. C., Morris, Illinois: Specimen of *Dipeltis diplodiscus*. 30859.

CARRICO, E. T., Moberly, Missouri: Arrowheads (31761); clays, shales, etc. (31987).

CARTER, E. B., St. Augustine, Florida: Two pieces of wood eaten by isopods, also specimen of isopod from St. Johns River. 31783.

CASAD, Miss ALICE. (See under T. D. A. Cockerell.)

CASE, H. B., Loudonville, Ohio: Specimen of *Conularia micronema* Meek, and a specimen of *Conularia newberryi* Hall. Exchange. 31374.

CASHMAN, N., Rochester, New York: Copper coin used during the reign of George III, 1797. 32194.

CASSADY, J. M., Camden, New Jersey: Specimen of *Castanea dentata*. 31176.

CASTEEL, J. N., Myrtle Creek, Oregon, transmitted by J. S. Diller. Tusks of a mammoth. 31512.

CENTRAL HIGH SCHOOL, Washington, District of Columbia, transmitted by W. P. Hay: Six birds' skins. Exchange. 31316.

CERAMIC ART COMPANY, Trenton, New Jersey: Porcelain campaign button. 31637.

CHAMBERLAIN, Dr. L. T., The "Chelsea," New York City: Land and fresh-water shells from Central America and the West Indies, representing 232 species (31839); 2 tourmalines from Paris, Maine (to be added to the Lea collection) (32227) (presented to the Smithsonian Institution and deposited in the National Museum).

CHAMPION, W. R., Hazel Green, Wisconsin: Photograph of arrow and spear heads (gift) (31981); galena from Wisconsin and Illinois (purchase) (32273).

CHAPMAN, R. H. (See under Interior Department, U. S. Geological Survey.)

CHAPMAN, S. H. & H., Philadelphia, Pennsylvania: Seven medals. Purchase. "N." 31876.

CHASE, Dr. A. G., Millwood, Kansas: Shell of a soft-shelled turtle belonging to the genus *Tryonyx*. 31549.

CHASTRAND, A. D., Matanzas, Cuba: Specimen of *Callidryas thalestris* Boisd. 31471.

CHERNELHÁZA STEFAN CHERNEL, VON, Köszeg, Hungary: Five birds' skins. Exchange. 31164.

CHICAGO ACADEMY OF SCIENCES, Chicago, Illinois, transmitted by F. C. Baker: Shells. (30929, 31657, 31956.)

CHIPMAN, W. F., San José, California: Four specimens of *Zygadenus piniculatis* (31939); specimen of *Monardella douglasii* (32148).

CHITTENDEN, N. H., San Diego, California: An unfinished tube or pipe of serpentine. 31782.

CHRISTCHURCH, NEW ZEALAND: CANTERBURY MUSEUM, transmitted by F. W. Hutton, curator: Ethnological and archæological objects. Exchange. 30996.

CINCINNATI SOCIETY OF NATURAL HISTORY, Cincinnati, Ohio, transmitted by Joshua Lindahl: Cast of a sandstone object. 32160.

CLARK, G. A., Stanford University, California: Skulls of young fur seals, and ovaries. 31425.

CLARK, James, London, England: A group of pearls found in a shell from Torres Straits, Thursday Island. 30886.

CLARKE, Prof. F. W., U. S. Geological Survey: Three meteoric specimens from Long Island. 31188. Presented to the Smithsonian Institution and deposited

CLARKE, Prof. F. W.—Continued. in the National Museum. (See under G. S. Fellows; W. J. Knowlton.)

CLARKE, Prof. JOHN M., Albany, New York: Plaster cast of a specimen of *Coronura diurus* Green. 31757.

COCKERELL, Prof. T. D. A., Las Vegas, New Mexico: Types and cotypes of species of Aculeate hymenoptera (30948); 2 Mexican plants (31042); types and cotypes of 22 species of hymenoptera (31061); Isopoda (*Sphæroma* sp. nov.), from a warm spring near Socorro, New Mexico, and a terrestrial Isopod from the edge of the spring (31621); black-headed snake, *Tontilla nigriceps* obtained by Miss Alice Casad (32003); specimen of *Halictus midosensis* Cockerell, a cotype from Sante Fe (32025); type specimen of *Cecidomyia neomexicana* Cockerell from Organ, New Mexico (32072). (See under Agriculture, Department of.)

COCKERTON, F. T., Danville, Illinois: Coal Measure mollusks representing 6 species (exchange) (31420); 400 specimens of Coal Measure plants, representing 21 species (exchange) (31543); fossil Nautilus, representing 2 species (gift) (31789).

COHEN, D. A., Alameda, California: Set one-fourth of eggs of Oregon Towhee runt eggs, and a runt of the California Partridge. 31247.

COLE, Miss ELLA A., Meadow Valley, California: Cocoon and moth of *Attacus ceanothi* Behr. 32042.

COLE, J. L., Manomet, Massachusetts: Specimen of sea-mouse. 31565.

COLEMAN, A. P., Practical School of Science, Toronto, Ontario, Canada: Freshwater shells, representing 2 species from the interglacial beds at Toronto. 32145.

COLINA, G. A., Museo Preistorico-Entografico, Rome, Italy: Model of a throwing-stick used by the Ozonana Indians of South America. Exchange. 31979.

COLLINS, F. S., Malden, Massachusetts: Specimens of sea-weeds. (31343, 31703.) Purchase.

COLLINS, J. F., Providence, Rhode Island: Twenty plants. Exchange. 31893.

COMES, Prof. O., Portici, Italy: Thirty-two specimens of *Nicotiana*. 30849.

COMSTOCK, Prof. J. H. (See under Cornell University.)

CONANT, F. S., Johns Hopkins University, Baltimore, Maryland: Crabs, representing 29 species from Kingston Harbor, Jamaica. 31436.

COOK, Prof. O. F., U. S. National Museum: Collection of myriopods and cryptogamic plants (deposit) (30981); 224 herbarium specimens comprising 164 specimens of African flowering plants and 60 African ferns (gift) (31086); 3 specimens of *Perideris* from Liberia, representing one species (gift) (31093); 2 specimens of *Haplochilus sexfasciatus* specimen of *Eleotris* sp., and a small Goby; also reptiles from Liberia (31014). (See under Hamburg, Germany: Hamburg Museum, and Berlin, Germany: Royal Museum of Natural History.)

COOK, Mrs. O. F., Care O. F. Cook: Four hundred and thirty-five herbarium specimens consisting of Spanish plants and plants from Massachusetts (31092); 14 specimens of algæ (31118); 297 plants from Massachusetts (31252).

COOLEY, BARTLETT, Galena, Kansas: Lead and zinc ores from Galena and North Empire, Cherokee County. 31810.

COOPER, Dr. J. G. (See under California Academy of Sciences.)

COPENHAGEN, DENMARK: Zoological Museum, transmitted by Dr. F. Meinert: Crabs, representing 32 species. Exchange. 31717.

COPINEAU, CH., Doullens, Somme, France: One hundred and seven dried plants. Exchange. 30957.

COQUILLETT, D. W., Department of Agriculture: Eight hundred and sixty specimens of Tachinidæ, representing 196 species and including 81 types of species (32084); type specimen of *Culex signifer* Coquillett (32098). (See under Charles Robertson.)

CORDLEY, Prof. A. B. (See under Oregon Agricultural College.)

CORNELL UNIVERSITY, Ithaca, New York, transmitted by Prof. J. H. Comstock: Invertebrates, representing 19 species, collected by the Cornell Expedition to Greenland in 1896. 31975.

CORNMAN, C. T., Carlisle, Pennsylvania: Bantam hen (31426); brown-red bantam fowl (32062).

CORY, Prof. C. B., Boston, Massachusetts: Eleven strings of beads obtained from the Seminole Indians. 32040.

CORY, C. B., Palm Beach, Florida: A young alligator and a young crocodile. 32004.

COSTA RICA, MUSEO NACIONAL DE, San José, Costa Rica: transmitted by Senor J. Fid Tristàn: Screech Owl, *Megascops* sp. (30850); 2 fresh-water crabs (32230).

COSSUM, Celia S., De Ruyter, New York: Fan, writing set, and a razor from Ningpo, China. 32086.

COVILLE, F. V., Department of Agriculture: Specimen of *Carum gairdneri* B & H; (31308); specimen of *Asimina triloba*. (31993.)

COUBEAUX, EUGENE, Boucher, Saskatchewan, Canada: Ten birds' skins. Exchange. 31719.

COUES, Dr. ELLIOTT, Washington, District of Columbia: Type specimen of *Junco danbyi* from South Dakota. 31157.

COURT, E. J., Washington, District of Columbia: Two eggs of a Turkey Buzzard and 2 eggs of a White Ibis. 31177.

COURTNEY, C. W., Doniphan, Idaho: Sample of diatomaceous earth. 32222.

COWDREY MACHINE WORKS, Fitchburg, Massachusetts: Specimen of wood. 31687.

COX, Miss HAZEL VAN ZANDT, Brightwood, District of Columbia: English Sparrow and a Parula Warbler, in the flesh (31154); young Goldfinch and a Phœbe, in the flesh (31182).

CRAFTS WILBUR (no address given). Suit of Mandan costume consisting of a coat, pants, and moccasins. Purchase. 31870.

CRAIG, R. L., Fossil, Wyoming, through F. H. Knowlton: Fossil Ray-fish. 31160.

CRANDALL, C. S., Fort Collins, Colorado: Eight specimens of Colorado Umbelliferæ. 31504.

CREVECOEUR, F. F., Onaga, Kansas: Six plants. 31418. (See under Agriculture, Department of.)

CROSBY, G. S., Pacific Grove, California: Two plants. 31598.

CROSS, WHITMAN. (See under Interior Department, U. S. Geological Survey.)

CROWN LANDS, DEPARTMENT OF. (See under Quebec, Canada.)

CULIN, STEWART, University of Pennsylvania, Philadelphia, Pennsylvania: Time-indicating lamp "Pride of America."

CUMMINGS, Miss C. E., Wellesley College, Wellesley, Massachusetts: Twenty specimens of *Myxomycetes*. Purchase. 31393.

CURTISS, A. H., Jacksonville, Florida: Three bulbs of *Hymenocallis caribæa* from near Indian River, Florida (gift) (30977); 5 specimens of *Commelina hirtella* (gift) (31067); specimen of *Acnida tuberculata* Moq. (gift) (31214); herbarium specimen of *Tradescantia* (gift) (31447); 200 specimens of Florida plants and 50 specimens of *Algæ floridanæ* (purchase) (31722).

DAGGETT, A. S., Washington, District of Columbia: Angora cat, in the flesh 31472.

DAGGETT, Hon. JOHN, U. S. Mint, San Francisco, California: Thirteen large photographs illustrating the industries of the Klamath Indians, San Francisco, California; also 2 plaster beads (exchange) (31277); 3 photographs (exchange) (31628); specimen of weaving in Klamath sipnook, or acorn storehouse, and 2 braids for fringe on garments (gift) (32190).

DAIL, J., Ayden, North Carolina: Specimen of *Polyporus conglobatus* Berk. 32001.

DALE, T. NELSON, Williams College, Williamstown, Mass. (See under Interior Department, U. S. Geological Survey.)

DALL, W. H., U. S. Geological Survey: Specimen of Hickory-borer, *Cyllene pictus* (gift) (31881); basket of Japanese bamboo-work (deposit) (32100); specimen of *Cypræa xanthodon* Gray, from Torres Straits (gift) (32179).

DANHAKE, JOHN, Washington, District of Columbia: Malformed egg of a duck. 31971.

DANIEL, J. W., jr., Lynchburg, Virginia: Thirteen birds' eggs, representing 6 species, also 2 birds' nests from Virginia and California. 31079.

DANIEL, Dr. Z. T., Carlisle, Pennsylvania: Lower incisors of a deer (30897); alcoholic snake (30932); suit of clothing made from the skin of a black-tailed deer (purchase) (31330).

DANIELS, L. E., Morris, Illinois: Specimen of *Dipeltis diplodiscus* (30860); shells from Indiana, representing 26 fresh-water species (31592).

DAVIDSON, Dr. A., Los Angeles, California: Spiders. 31029.

DAVIDSON, D. (See under Agriculture, Department of.)

DAVIS, J. WOODBRIDGE, New York City: Manuscript copy of the William Bartram manuscript, 2 photographs of Dr. E. H. Davis, and a chronological chart of the Human Period (with reference to Europe) by J. W. Davis. 31588.

DAY, Dr. D. T., U. S. Geological Survey: Minerals from Colorado, California, Oregon, Utah, and Pennsylvania (31184, 31305, 31405). (See under D. V. Donaldson.)

DAY, F. H., Boston, Massachusetts: Four photographs selected from the Washington salon. 31288.

DAYTON, C. N., Buffalo, New York: Ten photographs of ethnological objects and three photographs illustrating methods of transportation by horses and oxen. Purchase. 31098.

DEAN, S. B., New York City: Processional candlestick with seven branches, used in France during the fourteenth century. Purchase. 31855.

DEANE, Walter, Cambridge, Massachusetts. Five fragments of *Tiedemannia*. 31799.

DEISHER, H. K., Kutstown, Pennsylvania: Fossils. 31564. (See under Smithsonian Institution, Bureau of Ethnology.)

DELAFIELD, Miss EMMA, Washington, District of Columbia: Wax models of native fruits, wax flowers, and a collection of Mexican idols and other archæological objects from the Pyramids of Cholulæ and Teotihuacan. Presented to the Smithsonian Institution and deposited in the National Museum. 31989.

DE MIER, J. R., Lava, New Mexico: Specimens of *Ephedra trifurca*. 32109.

DENNISON, G. W., Smith's Island, via Port Townsend, Washington: Six eggs of *Corvus caurina*. 32144.

DEWEY, L. H., Department of Agriculture: Specimen of *Prionopsis ciliatus* (31150); 100 specimens of grasses from the District of Columbia (32151); 9 plants (32038); specimen of *Crinum* (32284).

DICKINS, Commander F. W., U. S. N.: Two clay pipes, found in a grave in the Island Cemetery, Newport, Rhode Island. 31696.

DICKHAUT, H. E., U. S. National Museum: Slab of supposed fossil marine plants from the Cincinnati formation, Covington, Kentucky. 31431.

DILLER, Dr. J. S. (See under J. N. Casteel; Interior Department, U. S. Geological Survey.)

DODGE, BYRON E., Richfield, Michigan: Collection of archæological objects, chipped stone and flint implements. (30979, 31506, 31747, 32193.) Deposit.

DONALDSON, D. V., Colorado Springs, Colorado: Three specimens of gold after telluride from Orepha May Mine, Cripple Creek District, a specimen of telluride ore containing a specimen of gold from Pike's Peak Mine, same locality, obtained through Dr. Day. 31186.

DOUBLEDAY, Mrs. ABNER, Washington, District of Columbia: Sword worn during the war of the rebellion by General Doubleday. Deposit. 31948.

DOZIER, S. B. (See under Smithsonian Institution, Bureau of Ethnology.)

DRAKE, C. M., Tacoma, Washington: Three species of marine shells from the western coast of the United States (gift) (31265); specimens of *Echinarachnius excentricus* Val., and *Strongylocentrotus dröbachiensis* Müller, and marine shells representing 2 species (gift) (32122); shells from Puget Sound (gift) (31408); seven starfishes, representing 2 species from Puget Sound (exchange) (32279); 2 specimens of *Venus* (gift) (32283).

DROWNE, F. P., Providence, Rhode Island: Snake, specimen of *Fundulus majalis*, marine invertebrates and larva of a carrion beetle inflated with mites. 30895.

DRUSHEL, J. A., Commerce, Texas: Specimen of *Astragalus distortus* T. & G. 31929.

DRYDEN, Dr. R. C., Winslow, Arizona, transmitted by the Fewkes Expedition, 1895–96: Tanning-tool of stone from Santa Clara Cañon. 31200

Du Boise, R. G., Washington, District of Columbia: The Horton automatic basket-making machine. 31844.

Dudley, W. R. (See under Agriculture, Department of.)

Dugès, Dr. A., Guanajuato, Mexico: Specimen of *Malvacea* and seeds of *Helianthus* (31368); specimens of *Anodonta* (31369); large root-gall, product of a cynipid, belonging to the genus *Andricus* (31673); specimens of *Anodonta* containing the animal (31697); galls of a cynipid on oak (31907); cynipid, *Synergus dugesi* Ashmead, a new species, and Curculionid, belonging to the genus *Otidocephalus* (31991); skin and skull of a mouse, tooth of a horse found in an Indian mound at Cuecillos, body of an abnormally shaped hen, and a tooth of a horse found at Penon Warm Springs, 2 tubes of gall-insects (32131).

Dunn, Mathew & Co., Great Falls, Montana, transmitted by G. F. Kunz: Sapphires, and sapphires in the matrix from near Utica, Montana. 31185.

Duvall, H. C., Washington, District of Columbia: Archæological objects from Missouri, Illinois, and Tennessee (31773); 4 specimens of pentremites from Illinois (31815); dust from supposed "blacksnow" (31954).

Dyar, Dr. H. G., New York City: Forty-one specimens of North American Saw-flies (Tenthredinidæ) representing 26 species, and including types of 19 species by Dyar and Marlatt. 31166.

Eakle, A. S., Washington, District of Columbia: Wire silver from Molly Gibson mine, Aspen, Colorado. 31770.

Eames, Dr. E. H., Bridgeport, Connecticut: Six hundred botanical specimens. Exchange. 31764.

Earle, Prof. F. S., Auburn, Alabama: Two specimens of *Trillium*. 32240.

Eastwood, Miss Alice, San Francisco, California: Forty-two plants from southeastern Utah. Exchange. 31037.

Eastwood, Fred., Philadelphia, Pennsylvania: Badge and ribbon, National Workingmen's Tariff League, Washington, District of Columbia. 32113.[1]

Eaton, A. A., Seabrook, New Hampshire: Twenty-seven specimens of *Equisetum* and 11 specimens of *Isætes*. 31930.

Eaton, G. F., New Haven, Connecticut: One hundred and seventy-two specimens of *Sphagna*. 31423.

Eckert, T. T. (See under Western Union Telegraph Company.)

Ellis, B. A., Fort Meade, South Dakota: Herbarium specimen of *Ranunculus glaberrimus* Hook (31715); 13 specimens of the same (32108).

Elmer, A. D. E., Pullman, Washington: Two hundred and thirty-two plants. Purchase. 31534.

Elrod, M. J., Bloomington, Illinois: Six small mammals from Snake River, Idaho. 31270.

Emerson, W. O., Haywards, California: Nest of Annas Hummingbird, *Calypte anna*. 30839.

Emmons, S. F., U. S. Geological Survey: Land shells from Peru, South America. 32048.

Engle, H. M., Roanoke, Virginia: Specimen of tscheffkinite from Bedford County, Virginia, and a specimen of samarskite from North Carolina. 31294.

English, G. L., & Co., New York City: Specimen of gersdorffite from Alova, Province of Malaga, Spain (exchange) (31401); gold and silver specimens (purchase) "N" (31898).

Enos, Mrs. D. C., Saratoga Springs, New York: Two specimens of *Lachnosterna arcuata* Smith. 32061.

Entriken, S. J., Chester, Pennsylvania: Eight models of Eskimo knots 31865.

Entwisle, Mr. (See under George Ayers.)

Ericson Brothers, Arcata, California: Twelve photographs of Klamath Indians. 31823. Received through G. P. Merrill.

De Erve, H. V., Hein, South Dakota: Specimen of *Belemnitella*. 32233.

Ernst, H. A., Youngstown, Ohio: Fifteen photographs of Seminole Indians from Florida. Purchase. 32207.

Evans, A. B., Philadelphia, Pennsylvania: Two miniature Liberty Bells, in porcelain. 31089.

Evermann, Prof. B. W., U. S. Fish Commission: Fifteen plants from southern Florida (31359); 139 plants from Idaho (31567); 47 specimens of lepidoptera, representing 17 species from Key West (31867); specimen of *Tradescantia* (31995).

[1] Received in a previous fiscal year.

EVERMANN, T. B., U. S. Fish Commission: One hundred and ninety-five specimens of lepidoptera, representing 44 species, from Idaho. 31866.

FAIRBANKS MUSEUM OF NATURAL HISTORY, St. Johnsbury, Vermont: Two photographs of bushmen, taken in Pretorea, Transvaal, South Africa. 31334.

FANNIN, JOHN. (See under Victoria, British Columbia: Provincial Museum.)

FARQUHAR, H., Department of Lands and Survey, Wellington, New Zealand: Echinoderms, representing 5 species from New Zealand. Exchange. 30873.

FARRINGTON, D. O. C. (See under Field Columbian Museum.)

FAXON, WALTER. (See under Museum of Comparative Zoology.)

FAY, H. W., De Kalb, Illinois: Photograph of an Indian arrowhead embedded in the rib of an animal (31044); cabinet-size photograph of Abraham Lincoln (32082).

FEATHERSTONHAUGH, THOMAS, Washington, District of Columbia: Collection of archæological objects from burial mounds near Lake Apopka, South Florida, and 5 photographs showing excavations in the mounds. 31781.

FELLOWS, G. S., transmitted by Prof. F. W. Clarke, U. S. Geological Survey: Specimen of onyx from near Pedrara, Lower California. 30999.

FERNALD, M. L., Gray Herbarium, Cambridge, Massachusetts: Two hundred and twenty plants from Maine. Purchase. 31487.

FERNOW, Dr. B. E. (See under C. H. Reid.)

FEWKES, Dr. WALTER, U. S. National Museum: Specimen of Cañon Diablo meteorite (31274); 3 musical instruments from Arizona and New Mexico, and 110 ethnological objects from the same locality (31785); pair of Moki moccasins (32079).

FIELD COLUMBIAN MUSEUM, Chicago, Illinois, transmitted by C. F. Millspaugh: Two hundred and eight specimens of plants from Yucatan (31084); transmitted by Dr. O. C. Farrington, specimens of Grecian marble, septurian nodule, barite and phosphorite. (32027)

FIGGINS, J. D., Smithsonian Institution: Water Thrush, *Seiurus motacilla* from Dismal Swamp, Virginia (31831); 2 sparrows (31840).

FILER, W. B., New York City: Four mammal skins and skulls and 60 birds' skins from Efulen, West Africa. 32298.

FISH COMMISSION, U. S., Hon. J. J. Brice, Commissioner of Fish and Fisheries: Two type specimens of shad (*Alosa alabamæ*) (30987); bone perforators, shell ornaments, etc., found in Indian graves at U. S. Fish Commission station, San Marcos, Texas, while excavating for ponds: collected by J. L. Leary, superintendent of the station (31009); types of new fishes collected by the steamer *Albatross* in the vicinity of the Hawaiian Islands, also a few from the coast of Lower California and the Galapagos Islands (31011); collection of marine invertebrates obtained in the course of oyster investigations made in Long Island Sound by the Fish Commission in 1890 and 1892 (31115); stone implements, fragments of pottery, human teeth taken from ponds at San Marcos, Texas (31167); specimen of river shrimp collected by Mr. S. G. Worth in North Carolina (31387); collection of new fishes from the Colorado and Columbia Rivers, and the type of *Trachyrynchus helolepis*, collected by Prof. C. H. Gilbert (31760); shells and mollusks obtained by the steamers *Fish Hawk* and *Albatross* and by field parties (31878); reptiles and batrachians from various parts of the United States (32002); specimen of *Unio cornutus* from Texas (32043); types of 41 new species of fishes (32201).

FISHER, Capt. WALTER, Washington, District of Columbia: Two specimens of Caspian Tern, in the flesh, from Four Mile Run, Virginia. 31169.

FISHER, WILLIAM J. (See under Dr. T. H. Bean.)

FLATH, J. A. (See under Agriculture, Department of.)

FLEMING, J. H., Toronto, Ontario, Canada: Two specimens of Brunnich's Murre from Ontario (gift) (31068); 10 specimens of Redpoll (*Acanthis*) (exchange) (31097).

FLODMAN, Mr. (See under P. A. Rydberg.)

FLOOD, O. D., Clinton, Massachusetts: Nine birds' skins from the Hawaiian Islands. Purchase. (One skin returned.) 31072.

FOETTERLE, J. G., Petropolis, Brazil: One hundred and seventy-two specimens of Brazilian lepidoptera, representing 115 species. Exchange. 30921.

FOOTE, Dr. A. E., Philadelphia, Pennsylvania: Gold and silver specimens. Purchase. "N." 31897.

FORTIETH PARALLEL SURVEY. Microscopic thin sections prepared by Prof. Ferdinand Zirkel for the Geological Exploration of the Fortieth Parallel, and transferred from the U. S. Geological Survey to the National Museum, by Mr. Arnold Hague, then custodian of the collections and slides belonging to the Survey. 32107.

FORWOOD, Dr. W. H., U. S. A., Soldiers' Home, Washington, District of Columbia: One thousand plants, representing Dr. Forwood's private collection (31901); 432 herbarium specimens from South Dakota (30902).

FOSS, MULBERRY, Forbestown, California: Two stone sinkers, an arrowhead, and a small paint mortar from Yuba County, California. 31838.

FRANCIS, JOSEPH, Pensacola, Florida: Skin of Great White Egret, *Ardea egretta*. 32232.

FRAZAR, G. B., West Medford, Massachusetts: Thirty-four rude chipped implements, a hammer stone, and a net sinker from Blackman's Point, Mansfield, Massachusetts. 31322.

FREDHOLM, A., Walbrook, Baltimore, Maryland: Specimen of *Plantago aristata* Mx., and a specimen of *Liatris graminifolia* Willd, variety *dubia*, Gray (31087); 4 herbarium specimens (31196).

FRIERSON, L. S., Frierson's Mill, Louisiana: Specimens of Unios (31071, 31127, 31486, 31640, 31833).

FRIX, A. M., Calhoun, Georgia: Rhinoceros Beetle, *Dynastes tityus*. 30990.

FROST, L. L., Susanville, California: Chipped quartzite disk, a pitted stone, and 2 obsidian arrowheads. 31910.

FUCHS, CHARLES, San Francisco, California: Two specimens of *Typhlusechus singularis* Linell. 32258.

FUCHS, H. T. (See under Agriculture, Department of.)

FULLER, E. G., Washington, District of Columbia: Specimen of *Fiber zibethicus*, from Potomac Flats. 31454.

FULLER, Miss FAY, Tacoma, Washington: Ten plants from Washington and Oregon. 31255.

FUR SEAL INVESTIGATION COMMISSION, through Prof. David S. Jordan: Squids, invertebrates, alcoholic specimens of birds, reptiles, and batrachians from Japan and Bering Sea. 31560.

GARDNER, N. L. (See under Agriculture, Department of.)

GARMAN, A., Agricultural Experiment Station, Lexington, Kentucky: Six specimens of *Elassoma zonatum*, specimen of *Chologaster cornutus*, and 3 specimens of *Diemyctylus viridescens*, variety *vittatus*, from Wilmington, North Carolina. 31934.

GARNER, EDWARD, Quincy, California: Thirty-four butterflies. 32295.

GAYLORD, HORACE, Pasadena, California: Set of eggs of California Screech Owl, and an abnormal egg of Desert Sparrow Hawk. 31245.

GENEVA, SWITZERLAND: MUSEE D'HISTOIRE NATURELLE, transmitted by Dr. N. D'Adelung. Insects comprising 84 specimens of orthoptera and crustaceans. Exchange. 32268.

GILBERT, C. H. (See under Fish Commission, U. S.)

GILBERT, Prof. G. K., U. S. Geological Survey: Sandstone with problematic markings from between Paria and Kiparowitz plateaus, southern Utah. 31571. (See under Agriculture, Department of.)

GILL, J. P., Albany, Georgia: Four Indian arrowheads. 31748.

GILL, Prof. THEODORE N., Smithsonian Institution: Fossil Unios, representing 4 species, from Niagara Falls (31057); specimen of *Mus musculus*, in the flesh (32167); abnormal egg of a domestic fowl (32204).

GILLESPIE, F. B., Stamford, Connecticut: Persian fiddle, "Kemangeh" (30909); musical instrument from East India (30985). Purchase.

GILMAN, COLLAMORE & Co., New York City: Delft or Faiënce specimen of ware. Purchase. "N." 32050.

GIRTY, G. H., U. S. Geological Survey: Fire clay from Sciotoville, Ohio, and

GIRTY, G. H.—Continued.
whetstone from Chagrin Falls, Ohio. 32384. (See under Interior Department, U. S. Geological Survey; Wilbur Stout.)

GIVEN, J. F., Decatur, Illinois: Photograph showing both sides of a metal medallion which was picked up in the catacombs at Rome. 32187.

GLAISHER, JAMES, South Croydon, England, transmitted by Prof. W. W. Johnson: Photographs of Mr. Glaisher. Presented to the Smithsonian Institution, and deposited in the National Museum. 31950.

GLATFELTER, Dr. N. N., St. Louis, Missouri: Fifty specimens of willows. Purchase. 31843.

GLOVER, Mrs. LUCY H., Brooklyn, New York: A very large and valuable collection of Chinese, Korean, and Japanese coins, consisting of 2,025 specimens, dating from 2254 B. C. to 1392 A. D., medals and amulets; also books written in the English and Chinese languages referring to the specimens comprising the collection. Bequeathed by Mr. George Bunker Glover, through his executrix, Mrs. Lucy H. Glover, to the Smithsonian Institution, and deposited in the National Museum. 32055.

GOAD, G. W., Phillips, Virginia: Seven rude chipped implements, a steatite vessel, and fragments of steatite vessels. Exchange. 31055.

GODDARD, HERBERT, Decorah, Iowa: Specimen of *Chrysosplenium alternifolium*. 32260.

GOLD, J., Santa Fe, New Mexico: Silver relic, of Spanish manufacture, dated about the year 1783. Purchase. 31446.

GOLDEN, R. A., & CO., Washington, District of Columbia: Albino Channel Catfish, *Amiurus albidus*. 30853.

GOOD, H. F., Springfield, Ohio: Specimen of *Bipalium kewense* Moseley. 31827.

GOODE, Dr. G. BROWN, U. S. National Museum: Chinese dulcimer. Purchased by Dr. Goode for the National Museum. 30966.

GOODE, Master PHILIP BURWELL, Washington, District of Columbia: Specimen of Dragon fly, *Epicordulia princeps* Hagen. 30946.

GOODRICH, Dr. E. S. (See under Oxford, England: Oxford University Museum.)

GORDON, R. H., Cumberland, Maryland: Fossils from the Niagara formation of Cumberland (31649, 31730, 31816).

GORMAN, M. W., Portland, Oregon: One hundred and thirty-nine plants. 31714.

GOULD, C. N., Winfield, Kansas: Specimen of *Serpula*, 3 specimens of *Ostrea franklini* Coquand, a specimen of *Gryphæa corrugata* Say, and 4 specimens of *Gryphæa* sp. 32262.

GRAHAMSTOWN, SOUTH AFRICA: ALBANY MUSEUM, transmitted by Dr. S. Schönland, Director: 37 birds' skins from South Africa (31249); 135 birds' skins from the same locality (32140). Exchange.

GRANT, Col. C. C., Hamilton, Ontario, Canada: Specimen of *Palæaster granti*, 61 specimens of Upper Silurian graptolites, and 8 specimens of miscellaneous fossils (30993); 51 Silurian graptolites (31569).

GRANT, F. H., Melborne, Victoria, Australia: Twenty-five fossil seeds. 31542.

GRAY HERBARIUM, Botanic Garden, Cambridge, Massachusetts: Sixteen herbarium specimens. Lent. (Returned.) 31699.

GRAY, Mrs. M. F., Washington, District of Columbia: Four plants. 32134.

GREELY, A. W. (See under War Department, U. S. Signal Office.)

GREEN, BERNARD, Washington, District of Columbia: Building stones. 30959.

GREENE, Prof. E. L., Catholic University of America, Washington, District of Columbia: Four plants. 32157.

GREENMAN, J. M., Cambridge, Massachusetts: Two herbarium specimens of Umbelliferæ from California (30874); specimen of *Acacia* from Cuba. (31501.)

GREGER, D. K., Fulton, Missouri: Twelve plants from Missouri (gift) (30884); land and freshwater shells, representing 18 specimens from Callaway County (gift) (31174); 17 specimens of brachiopods and a crinoid (gift) (31550); 29 specimens of Devonian and Carboniferous fossils representing 19 species (exchange) (31729).

GREGORY, JAMES, El Paso, Texas: Portion of a root of *Acerates viridiflora*. 30927.

GRESLEY, W. S., Erie, Pennsylvania: Thirty-three specimens of Algonkian iron ores from Michigan, containing

GRESLEY, W. S.—Continued.
probable impressions of plants and trailings of animals. 31473.[1]

GRIFFIN, GEORGE, North Head, Grand Manan, New Brunswick, Canada, transmitted by Major Bendire: Two specimens of starfishes, comprising *Asterias vulgaris* and *Cribella sanguinolenta*. 31240.

GRIFFITHS, DAVID, care Department of Agriculture: Five specimens of dried plants from South Carolina. 31239.

GRINDALL, Dr. C. S., Baltimore, Maryland: Five pigeons. 32163.

GRINNELL, G. H., Holbrook, Massachusetts: Specimen of *Corallorhiza multiflora*. 31078.

GRINNELL, JOSEPH, Pasadena, California: Seven specimens of *Chamæa* from California (31427); 12 skins of *Aphelecoma* from the same locality (31661); 9 specimens of Towhee, including types of *Pipilo maculatus clementæ* (32056).

GURLEY, Dr. R. R., Clark University, Worcester, Massachusetts: Graptolites. 30861.

GUTHRIE, OSSIAN, Chicago, Illinois: Glacial bowlders from ground moraine near Chicago (gift) (31909); native copper from glacial drift (purchase) (31391); specimen from a Huronite bowlder found about 20 miles south of Chicago (gift) (32247).

HAGUE, ARNOLD. (See under Fortieth Parallel Survey.)

HALL, D. F., Creston, Iowa: Small piece of leather made from human skin. 32170.

HAMBURG, GERMANY: HAMBURG MUSEUM, Prof. Kraepelin, Director, transmitted by Prof. O. F. Cook: Thirty-five jars containing myriapoda belonging to the family Spirostreptidæ. Lent. 31338.

HAMILTON, BOURNE, Washington, District of Columbia: Skin of a Rocky Mountain Sheep, *Ovis montana*. 31278.

HAMILTON, JAMES M., Coahuila, Mexico: Specimen of *Corillea divaricata*. 30969.

HAMILTON, Mr., Washington, District of Columbia: Sharp-shinned Hawk, in the flesh. 31272.

HAMLINE UNIVERSITY, St. Paul, Minnesota, transmitted by Prof. H. L. Osborn: fifty-six specimens of marine shells from the Philippine Islands. 31123.

HAMMOND, Mrs. C. W., Argyle, Washington: Specimens of *Corralina*. 31625.

HANSELMAN, J. J., Brooklyn, New York: Pigeon, in the flesh. 30926.

HARDY, MANLY, Brewer, Maine: Trout. 30984.

HARRINGTON, W. H., Ottawa, Canada, transmitted through W. H. Ashmead: Thirty specimens of parasitic Hymenoptera, representing 11 species. 31351.

HARRISON, Miss CARRIE, U. S. National Museum: Specimen of *Koelreuteria*. 30876.

HART, J. J., Botanic Garden, Trinidad: Herbarium specimen of *Sacoglottis amazonica* Mart (gift) (31119); specimen of the same (exchange) (31210).

HART, WILLIAM W. & Co., New York City: Two skins of Mount St. Elias Bear, *Ursus emmonsi*. Purchase. 31759.

HARVARD UNIVERSITY, HERBARIUM OF, Cambridge, Massachusetts: 14 sheets of *Crantzia*, and 32 sheets of *Heliocarpus*. Lent. Returned. 31962.

HASBROUCK, Dr. E. M., Washington, District of Columbia: Two hundred and eighteen birds' skins (31234); 110 birds' skins (31556). Purchase.

HASKEL, P. D., Washington, District of Columbia: Specimen of *Chrysopsis falcata* from Massachusetts. 31063.

HASWELL, C. H., New York City: Model of the first steam boiler-riveting machine. 31871.

HAVENS, J. G. W., Point Pleasant, New Jersey: Alcoholic specimen of Sea Hare. 31243.

HAWKS-POTT, Rev. F. L. (See under Shanghai, China, St. John's College.)

HAWLEY, F. H., New York City: Lundell Electric motor and a set of Morse telegraph instruments, relay sounder, and key on one board. 31821.

HAY, W. P., Central High School, Washington, District of Columbia: Large collection of crayfishes. Exchange. (See under Central High School.) 31622.

HAYMOND, Mrs. DORCAS, Morgantown, West Virginia: Ware from an old pot-

[1]Types illustrated in "Traces of organic remains from the Huronian series at Iron Mountains, Michigan, etc."

HAYMOND, Mrs. DORCAS—Continued. tery in Morgantown, stamps, dies, etc. Transmitted by Walter Hough. 31352.

HAYNES, F. Jay. (See under Interior Department.)

HEIDEMANN, O., Petworth, District of Columbia: Two beetles and two insects from Canary Islands. (The beetles proved to be new to the Museum collection.) 32287.

HEIKS, V. C., Mercur, Utah: Specimens of orpiment and associations from Mercur mine, Mercur, Sunshine district, Tooele County. 31544.

HELIOTYPE PRINTING COMPANY, Boston, Massachusetts: Chromo-collograph made from nature, from a piece of Mexican onyx, by the three-color selective process. 31809.

HELLER, A. A., Lancaster, Pennsylvania: Plants from Idaho and the Hawaiian Islands. (30904, 30997, 31035, 31227, 31435.) Purchase.

HEMPEL, ADOLPH, Gotha, Florida: Specimen of *Diemyctylus viridescens*. 31763.

HEMSLEY, W. B., Royal Botanic Gardens, Kew, England: Fragments of *Juniperus occidentalis*. Exchange. 31800.

HENRY, Miss M. A., Washington, District of Columbia: Eighteen pieces of electrical apparatus (32991); 40 diplomas, 19 medals, etc., presented to Prof. Joseph Henry (32292); 11 objects, consisting of letters, books, documents, pamphlets, also portraits of Professor Henry and others (32293); first scientific book read by Professor Henry, entitled "Letters on Experimental Philosophy, Astronomy, and Chemistry," by G. Gregory, Volume 1, 1808 (32294). Deposit.

HENSHAW, H. W., Hilo, Hawaiian Islands, transmitted through Dr. Stejneger: Specimens of Longicorn Beetle, *Plagithmysus varians* Sharp, from Kilauea, Hawaii (31491); collection of lizards from Hawaii (31754).

HERMAN, W. W., Boston, Massachusetts: Land and fresh-water shells, representing 9 species, from various localities (31409); shells from Mauritius (31467).

HERSHEY, O. H., Freeport, Illinois: Sixteen specimens of Cincinnati group fossils. 31913.

HERZER, Rev. H., Columbus, Ohio: Four specimens of *Psaronicus*. 31955.

HESS, I. E., Philo, Illinois: Nest of Wood Pewee, *Contopus virens*, and of Maryland Yellow-throat, *Geothlypis trichas*. 31680.

HESSLER, ROBERT, Logansport, Indiana: Eight herbarium specimens. 31452.

HETHERINGTON, W. P., Belding, Michigan: Specimens of marl. 31002.

HEWITT, A., Winnebago City, Minnesota, transmitted by Major Bendire: Krider's Hawk and a Red-tailed Hawk (30851); set of eggs of Krider's Hawk (new to the Museum collection) (31049).

HEYDE, Rev. H. T., Vera Cruz, Mexico: Thirty-one birds' skins. Purchase. 31516.

HIGGINS & SEITER, New York City: Two Washington jugs, of porcelain. 31576.

HILBORN, Hon. S. G. (See under W. C. Burger.)

HILBOURN PRINTING COMPANY, Hart, Michigan: Tomato Hawk Moth, *Protoparce celeus*. 30922.

HILDEBRANDT, A. M., College Station, Texas: Plants. (32095, 32185.)

HILL, Dr. R. T., U. S. Geological Survey: Specimen of native bitumen and 3 specimens of bitumen rock from Uvalde County, Texas (31309); specimen of gypsum from 3 miles north of Sweetwater, Texas, and a specimen of quartz in granite from Burnet County (32156). (See under Interior Department, U. S. Geological Survey.)

HILLEBRAND, Dr. W. F., U. S. Geological Survey: Specimens of prosopite from near Lewiston, Utah. 31066.

HILLMAN, U. H., Forest Dale, Massachusetts: Specimen of *Chrysanthemum leucanthumum*. 30989.

HIND, Dr. WHEELTON, Stoke-upon-Trent, England: Two hundred and ten specimens of English carboniferous pelecypods, representing 36 species. Exchange. 30896.

HINTON, Prof. W. B., Kissimmee, Florida: Part of a specimen of White-winged Dove, *Melopelia leucoptera*. 31348.

HINTZE, ALEX., Helsingfors, Finland: Two specimens of Lapp Owl from Finland. 32090.

HIPPISLEY, A. E., Commissioner of Customs, China, transmitted by Hon. W. W. Rockhill: Collection of lamps and candlesticks from China. 30941.

HITCHCOCK, Prof. C. H., Hanover, New Hampshire: Geological material illustrating the geological sections across New Hampshire and Vermont. 31520.

HITCHINS, G. D., Brighton, Virginia: Snake. 32257.

HOBBS, B. S., Brooklyn, New York: Specimen of obsidian from near Cali, State of Cauca, Colombia. 30954.

HODGE, Dr. E. R., Army Medical Museum, Washington, District of Columbia: Snake (30833); 10 specimens of Confederate paper money (32116).[1]

HOFFMAN, Dr. W. J., Washington, District of Columbia: A carved hard-wood pestle from Doublinggap, Pennsylvania. 31064.

HOLCOMB, E. G., Brasher Iron Works, New York: Stone implement. Exchange. 31585.

HOLM, T. W., Department of Agriculture: Twenty-three specimens of fungi from Denmark and Sweden. 31054.

HOLMES, J. A., Chapelhill, North Carolina, transmitted through U. S. Geological Survey: Contact of vein and wall rock from Painter Mica Mine, near Sylvia, Jackson County. 30973.

HOLMES, J. S., Bowmans Bluff, North Carolina: Specimen of Spadefoot, *Scaphiopus holbrookii*. 31886.

HOLMES, S. J., Chicago, Illinois: Crabs, representing 3 species, and an isopod from the western coast of North America. Exchange. 31402.

HOLT, H. P. R., Takoma Park, District of Columbia: Cut-glass globe of an astral lamp, 80 years old, and a pair of snuffers. 31828.

HOLZINGER, J. M., Winona, Minnesota: Eleven herbarium specimens of Umbelliferæ from Colorado (31396); specimen of moss, representing a portion of a type of *Hypnum cyclophyllotum* (32009).

HOLZNER, F. X., San Diego, California: Alcoholic reptiles and mollusk. 30962.

HOOD, S. B., Sparta, Illinois: Specimen of pyrite. 31961.

HOOPER, J. J., Selma, Alabama, transmitted by Johns Hopkins University, Baltimore, Maryland: Neuropterous fly, *Corydalus cornutus*. 30835.

HOPKINS, Miss SUE, Melbourne Beach, Florida: Three specimens of *Commelina erecta* and two of *Tradescantia rosea* (30937); six specimens of seaweed (31085); 8 plants (31204).

HOPPING, RALPH, Kaweah, California: Beetles, representing 85 species. 31688.

HORAN, HENRY, U. S. National Museum, through Joseph Horan: Nineteen ribbon badges and a metal badge. 31390.

HORAN, JOSEPH. (See under Henry Horan.)

HORIGAN, M. E., Washington, District of Columbia: Farrier's knife. 31775.

HORNER, R. M. (See under Agriculture, Department of.)

HOSTETTER, KARL, Minerva, Ohio: Four rude chipped implements and other archæological objects. Exchange. 31048.

HOUGH, Dr. WALTER, U. S. National Museum: Fossil plants and animals (31382); 16 prehistoric objects from a cave at Mentone, France (31440). (See under Mrs. Dorcas Haymond.)

HOW, Rev. HENRY, Annapolis Royal, Nova Scotia: Photograph of a gold figurine found in Costa Rica. 32092.

HOWARD, L. O., Department of Agriculture: Pack of Spanish playing-cards found in the hole of a spermophile near an Indian hut in Tucson, Arizona. 31766.

HOWARD, N. C., Mathis, Texas: Herbarium specimen. 31038.

HOWE, M. A., Newfane, Vermont: Four specimens of *Junci*. 31102.

HOWELL, E. E., Washington, District of Columbia: Polished section of a flint nodule from England (exchange) (30934); specimen of rutile in quartz, specimen of rutilated quartz from Madagascar, and a specimen of variscite from Utah (purchase) (30940); corundum from Corundum Creek, Pine Mountain, Georgia (exchange) (30992); reel, from the homestead of Samuel Perry, Maine, and a sealing stick (exchange) (31109); native gold in quartz from Greenwood Mine, near Chancellorsville, Virginia (purchase "N") (31672); specimen of calcite (sinter), specimen of stephanite, specimen of argentite, and specimen of chalcostibite (purchase "N") (31691); 3 specimens of *Calymena callicephala*, 3 specimens of

[1] Received in a previous fiscal year.

HOWELL, E. E.—Continued.
Asaphus gigas, 2 specimens of *Dendrocrinus polydactylus*, and a specimen of *Conularia chesterensis* (purchase "N") (31706); specimen of kylindrite from Poopo Choro, Bolivia (purchase "N") (31749); 8 fossil Trilobites (purchase "N") (32165); specimens of elaterite from England, sal ammoniac from Sicily, and placer gold from Eagle Creek, Birch Creek district, Alaska (exchange) (32242).

HOWELL, THOMAS, Clackamas, Oregon: One hundred and thirty-four plants from southern Alaska. Purchase. 30913.

HOYLE, W. E. (See under Manchester, England. Manchester Museum.)

HUBBARD, H. G., Washington, District of Columbia: Seventy-six species of coleoptera from Montserrat, West Indies (gift) (31016); coleoptera, representing 42 species, from Jamaica (gift) (31025); 58 specimens of hemiptera, representing 9 species of *Larrea tridentata* and *Prosopis juliflora*, from Tucson, Arizona (31492); coleoptera, representing 69 species from North America (all new to the Museum collection) (exchange) (31493); specimens of hymenoptera from the arid regions of Arizona (gift) (31904); 2 specimens of *Chramesus* n. sp., and 8 specimens of parasitic hymenoptera bred from them (gift) (32259).

HUDSON, Dr. J. W., Ukiah, California: Photographs and working drawings of a Ukiah house (31082); 8 photographs of paintings of Pomo and Ukiah Indians of California (31131).

HUDSON, Mrs. J. W., Ukiah, California: Oil painting of a Pomo Indian. 32063.

HUETT, J. W., Ottawa, Illinois: Specimen of *Sambucus pubens dissecta*. 31912.

HUNTER, CHARLES, Mammoth Hot Springs, Wyoming: Soapstone mortar. 31466.

HUNTER, WILLIAM, Washington, District of Columbia: Plants (30855, 30903, 31820, 31860, 31892).

HURTER, JULIUS, St. Louis, Missouri: Two specimens of reptiles. Exchange. 31580.

HUTCHINSON, I. W., Abbeville, South Carolina: Specimen of monazite sand after the reduction of the ore. 31111.

HUTTON, F. W. (See under Christchurch, New Zealand: Canterbury Museum.)

IHERING VON, Dr. H., Museu Paulista, San Paulo, Brazil: Shells from Brazil and fossils from Santa Cruz formation, Patagonia (30935); shells from Brazil (31917).

IJIMA, Dr. I. (See under Tokyo, Japan: Science College of the Imperial University.)

INGERSOLL, J. C., Bowie, Maryland: One hundred and sixty-three birds' skins from Florida. Purchase. 31019.

INTERIOR DEPARTMENT: Ten photographs or sketches made by Mr. F. Jay Haynes, Mammoth Hot Springs, Wyoming, of scenes on the Yellowstone National Park (32206).

United States Geological Survey, Honorable Charles D. Walcott, Director: Eighty-six herbarium specimens collected by F. H. Knowlton (30863); 50 plants from Colorado, collected by F. H. Knowlton (30872); specimen of *Dryopteris acrostoides* sent by Dr. G. H. Girty (30880); duplicate specimens of Upper Miocene fossils from Nansemond River, near Suffolk, Virginia (30980); specimen of wollastonite from New Hartford, New York, and a specimen of pyrite in schist from Sitka, Alaska (31065); 63 plants from Wyoming, collected by F. H. Knowlton (31281); 68 specimens of minerals from various localities (31319); 2 bones of Morotherium, collected by Dr. J. S. Diller (31395); a collection of rocks made by Mr. W. Lindgren in Nevada City and Grass Valley, and 252 slides (31451); geological material to illustrate Prof. H. W. Turner's paper in the Fourteenth Annual Report of the U. S. Geological Survey, on the rocks of the Sierra Nevada (31525); phosphate rock from Reeds Gap, Juniata County, Pennsylvania, and Quincy, Florida (31527); specimen of psilomelane, after pyrolusite, from Phillipsburg, Montana, collected by W. H. Weed (31664); specimen of calamine from Elkhorn Mine, Elkhorn, Montana, also collected by Mr. Weed (31665); geological material collected in Colorado by Mr. Whitman Cross, and 2 basaltic bombs obtained in New Mexico by Dr. R. T.

INTERIOR DEPARTMENT—Continued.

Hill (31684); rocks from Arkansas and sodalite-syenite from Square Butte, Montana, obtained by W. H. Weed (31705); trap dikes of the Lake Champlain region, collected by Mr. Whitman Cross and Mr. J. F. Kemp (31731); geological material from Pikes Peak, Colorado, collected by Mr. Whitman Cross (31732); geological material from Cripple Creek, Colorado, collected by Mr. Whitman Cross (31733); geological material also obtained by Mr. Cross in Gunnison, Colorado (31734); geological material from the Tewan Mountains, New Mexico, collected by Maj. J. W. Powell (31735); 81 specimens of covellite from Butte District, Montana, collected by George W. Tower (31750); 270 specimens of Devonian and Carboniferous fossils from Montana, collected by W. H. Weed (31762); 4 Buffalo heads taken from animals killed by poachers in the Yellowstone Park in 1894 (31777); collection of Paleozoic rocks consisting of 214 specimens, collected by T. Wayland Vaughan in Oklahoma and Indian Territories (31852); a series of roofing slates from eastern New York and western Vermont, showing cleavage, color variation, and general physical characteristics, collected by T. Nelson Dale (31900); type specimens of *Gastriceras branneri* and *Pronorites cyclolobus arkansiensis* Smith, transmitted from Yale University, New Haven, Connecticut, by Prof. H. S. Williams (31959); specimen of galena and a specimen of wire silver, argentite, and calcite from Aspen County, Colorado, collected by J. E. Spurr (31965); 5,545 specimens of Middle Cambrian Medusæ and 1,250 specimens of Middle Cambrian Trilobites, from Alabama, constituting collections made by Mr. Henry Bufford, of Blaine, Alabama, under the direction of Mr. Walcott (31976); 18 photographic prints (32066); specimen of kaolinite from Red Mountain, Colorado, collected by Mr. Whitman Cross (32096);

INTERIOR DEPARTMENT—Continued.

Carboniferous plants from Tremont, Pennsylvania, collected by Mr. David White (32168); type specimen of rocks from the Leucite Hills, Wyoming (32218);[1] calcite corroded with pyrite, from Neihart, Meagher County, Montana, collected by R. H. Chapman (32241). (See under T. H. Aldrich; Horace M. Engle; Fortieth Parallel Survey; Geological Survey of Japan; J. A. Holmes; Mrs. Moore; Willets Manufacturing Company, and F. H. Williams.)

IOWA, STATE UNIVERSITY OF, Iowa City, transmitted by Prof. C. C. Nutting: Fifty-two microscopic slides of Plumularian hydroids, collected by the Expedition of the State University of Iowa to the Bahamas in 1893; species of crabs obtained by the same expedition. Exchange (32029, 32049).

JAPAN, GEOLOGICAL SURVEY OF, transmitted from the U. S. Geological Survey: Chalcedony from Oguni village, Oitama District, Uzen Province, Japan. 32300.

JEPSON, W. L., Berkeley, California: Fourteen specimens of Umbelliferæ. 31508.

JOHANNES, J. W., Washington, District of Columbia: Set of birds' eggs. 31285.

JOHNS HOPKINS UNIVERSITY. (See under J. J. Hooper.)

JOHNSON, Professor W. H. (See under Smithsonian Institution and James Glaisher.)

JOHNSON, CLAUDE M. (See under Treasury Department, Bureau of Engraving and Printing.)

JOHNSON, C. E., Washington, District of Columbia. Table yarn-reel. 32119.

JOHNSON, J. N., Celestia, South Carolina: Specimens of pyrite crystals. 30982.

JOHNSTON, J. P., Washington, District of Columbia: Worm. 31483.

JOHNSTON, Dr. WYATT, Montreal, Canada: Specimens of *Opisthorchis sinensis*. 31653.

JONES, M. E., Salt Lake City, Utah: Five specimens of Umbelliferæ. 31645.

[1] The collection includes specimens of orendite, wyomingite, wadupite, and inclusions in orendite, collected by Whitman Cross June 12, 1897. The types are described in a manuscript published by the Geological Survey.

JORDAN, Dr. D. S. (See under Fur-Seal Investigation Commission.)

JUDSON, Mrs. ISABELLE FIELD, Dobbs Ferry-on-Hudson, New York. Objects relating to the Atlantic telegraph cable, etc. (32289); objects of the same character, and testimonials to Cyrus W. Field, etc. (32290).

JUDSON, W. B., Highland Park, California. Humming bird, representing a new species of *Atthis* from Arizona, also nest and 2 eggs of Broad-billed Humming bird (new to the Museum collection). 31284.

KANE, W. G., Kansas City, Missouri: Five specimens of biotite inclosing muscovite, from Custer, South Dakota. Exchange. 31116.

KAN KO BA, New York City: Tiger, old Bizen ware used early in the eighteenth century. Purchase. "N." 31935.

KARNTEN, AUSTRIA: TIROLER BOTANIKER, DIE FREIE VEREINIGUNG, transmitted by Hans Simmer, secretary: One hundred and eighteen lichens. Exchange. 30885.

KAYSER, WILLIAM, Wapakoneta, Ohio: Lepidoptera from Nevada and Ohio, representing 30 species. 31668.

KEANEY, W. M., Desoto, Missouri: Specimen of *Ephedra trifurca*. 31845.

KEARNEY, T. H., jr., Department of Agriculture: Fifteen plants from Tennessee. Exchange. 31602.

KEEN, Rev. J. H., Massett, Queen Charlotte Islands, British Columbia: Coleoptera, representing 8 rare species, from Queen Charlotte Islands (exchange) (30856); 300 specimens of coleoptera, representing 38 species (new to the Museum collection (gift) (31222).

KEEFER, C. A. (See under Sir Alfred Moloney.)

KELEKIAN, D. G., New York City: Koran, Mosque doorknocker, Koran talisman, dervish crouch, dervish belt buckler, dervish alms receiver, and an Egyptian manuscript scroll. Purchase. "N." 31915.

KELLY, J. E., New York City: Copperplate engraving of John Ericsson. 31310.

KEMP, J. F. (See under Interior Department, U. S. Geological Survey.)

KENDALL, W. G., Boston, Massachusetts: Runt Pigeons. (31595, 31623.)

KENESAW MARBLE COMPANY, Marietta, Georgia: Two pieces of verde antique marble. 31015.

KENT SCIENTIFIC INSTITUTE, Grand Rapids, Michigan, transmitted by C. A. Whittemore: Three birds' skins from Guatemala. Exchange. 31056.

KESSLER, FRANK, New York City: Specimens of onyx from San Luis Obispo, California. (31927 gift); (31928 purchase).

KEY, CLARENCE, Park View, New Mexico: Deposit obtained from melted snow. 31977.

KIEL, GERMANY: ZOOLOGICAL INSTITUTE, transmitted by Dr. K. Brandt: Crustaceans. Exchange. 31693.

KINDLE, E. M., New Haven, Connecticut: One hundred and sixty fossil plants. Purchase. 31529.

KING, CHARLES DANA, Wahpeton, North Dakota: Fragments of pottery from an old Indian camp, 6 miles south of Heart River on the Missouri River. 31841.

KIRKLAND, Dr. R. J., Grand Rapids, Michigan: Unios, representing 2 species (31479); Unionidæ, representing 5 species (31566); leeches and beetle larvæ of *Psephanius lecontei* (31600); crayfish and leeches from Plaster Creek, Michigan (31601).

KIRSCH, P. H., Indiana Commissioner of Fisheries, Columbia City, Indiana: Specimens of *Cambarus immunis* and *Cambarus propinquus* (30894); land and fresh-water shells, representing 15 species (31021).

KNAUS, WARREN, McPherson, Kansas: Eight specimens of *Lachnosterna calceata* Leconte from Kansas (30900); 2 specimens of *Lachnosterna hirtiventris* Horn (31190).

KNAUTH, E., Union Square, New York, transmitted by G. F. Kunz: Sapphires from Yogo Gulch, French Bar, and elsewhere in Montana. 31070.

KNIGHT, Prof. W. C., University of Wyoming, Laramie, Wyoming: Fifty-one specimens of Jurassic fossils and a specimen of Cretaceous fossil, also 18 rude quartzite implements found near Laramie. Exchange. 31767.

KNOWLTON, F. H., U. S. Geological Survey: Specimen of *Solidago* from Laurel,

KNOWLTON, F. H.—Continued.
Maryland (gift) (31125); fossil insect (gift) (31161); 59 birds' skins (exchange) (32253). (See under R. Lee Craig; Interior Department, U. S. Geological Survey.)

KNOWLTON, W. J., transmitted by Prof. F. W. Clarke, U. S. Geological Survey: Two cut opals from Queratero, Mexico. 30949.

KNUDSEN, WALDEMAR, Waimea, Kauai, Hawaiian Islands: Lizards from Kauai. 31771.

KNY-SCHEERER COMPANY, New York City: A series of 8 models by Zeigler, showing the development of the brain. Purchase. "N." 31969.

KOEBELE, A. (See under Agriculture, Department of.)

KOEHLER, Dr. R., Lyons, France: Invertebrates from the Gulf of Gascogne, representing 21 species, and mollusks representing 3 species. Exchange. 32234.

KOWALEWSKI, Dr. M., Dublany près Léopol, Galicia, Austria: Specimens of *Bilharzia polonica*, *Echinostomum echinatum*, *Echinostomum conoideum*, and *Echinostomum recurvatum*. Exchange. 31456.

KRAEPELIN, Professor. (See under Hamburg, Germany: Hamburg Museum.)

KRUGER, P. W., Cleveland, Ohio: Insects, representing 3 species. 32046.

KUNZ, G. F., New York City: An enameled souvenir cup given to the populace by Nicolas III on the occasion of his coronation (gift) (30901); specimen of banded corundum from Georgia (gift) (31306); Korean game of incense or odors, Chinese filigree and carved shell lamp and a terra-cotta candlestick, a processional cross from the church of San Domingo, Valley of Mexico; 75 bronze medals of the Kings of France, and 230 antique Tassie pastes of the eighteenth century (purchase) (31365). (See under E. Knauth; Mathew Dunn & Co.)

KUNZIE, Mrs. HELEN KANE, Umatilla, Oregon: A sculptured stone resembling the head of an ape. Purchase. 31875.

LACOE, R. D., Pittston, Pennsylvania: Two hundred and eight specimens of Tertiary plants from Florissant, Colorado. To be added to the "Lacoe collection." 32044.

LAFLER, H. A., Dewitt, Nebraska: Specimens of *Apus*, *Eulimnadia*, and *Estheria*. 30907.

LAMB, F. H., Stanford University, California: Three hundred and twenty-five plants from western Mexico. Purchase. 31314.

LANGDALE, J. W., Washington, District of Columbia: Specimen of kaliophilite from Monte Somma, Italy (gift) (31794); rocks and minerals from the District of Columbia (exchange) (32228).

LANO, ALBERT, Aitkin, Minnesota: Birds' skins. Exchange (31494, 31689.)

LARTET, L. (See under Lyons, France: Museum of Natural History.)

LARUT, PERAK, Straits Settlements: Perak Museum, transmitted by L. Wray, jr.: Land and fresh-water shells, representing 15 species, from Straits Settlements. 31643.

LASSIMONNE, S. E., Moulins (Allier), France: Two hundred and twenty-three plants. Exchange. 31428.

LATCHFORD, F. R., Ottawa, Canada: Specimens of *Unio borealis*. 31191.

LEARY, J. L. (See under Fish Commission, U. S.)

LECHE, Prof. WILHELM, Stockholm, Sweden. Crustaceans, representing 24 species. Exchange. 31136.

LEE, W. T., University of Denver, University Park, California: Forty-nine herbarium specimens. Lent. Returned. 31022.

LEESE, P. H., Espanola, New Mexico: Archæological objects found near Santa Clara pueblo, New Mexico. 32102.

LE GRAND QUARRY COMPANY, Marshalltown, Iowa: Dressed cubes of building stones, and a rock slab containing 42 perfect crinoid heads. 31826.

LEHAN PAUL, Allegheny, Pennsylvania: Specimen of *Attacus cecropia* L. 32075.

LEHMAN, W. V., Tremont, Pennsylvania: Coal plants. (31379, 31499.)

LEIBERG, J. B., Department of Agriculture: One hundred and fifty-three dried plants. Purchase. 31170. (See under Agriculture, Department of.)

LEITER, JOSEPH, Washington, District of Columbia: Specimen of Roseate Spoonbill, *Ajaja ajaja*, from Texas. 31514.

LELAND STANFORD JUNIOR UNIVERSITY. (See under Agriculture, Department of.)

LELING, Dr. HANS, Zurich, Switzerland: Eighty specimens of African dried plants. 31181.

LEMKE, Mrs. ELIZABETH, Berlin, Germany: Belt loom and distaff from east Prussia. Exchange. 31795.

LENDENFELD, VON Prof. R., Universitat, Czernawitz, Austria: One hundred and twenty-four microscopic slides of sponges. Purchase. 32175.

LEONARD, Miss G. L., Washington, District of Columbia: Copper hook found in the glacial drift on the Michigan side of the Sault Ste. Marie River. Deposit. 31411.

LESSER, J., Winston, Arizona: Meteoric iron from Canyon Diablo, Arizona. Purchase. 31107.

LEWIS, E. C., Forney, Texas: Four bulbs of *Cooperia drummondi*. 31104.

LEWIS, G. A., Wickford, Rhode Island: Silvery Hair-tail, *Trichiurus lepturus* (30847); Winter Flounder *Pseudopleuronectes americanus* (albino) (32041).

LINCOLN, H. D., Cottage Grove, Oregon: Specimen of *Telea polyphemus* Cramer. 32147.

LINDAHL, JOSHUA. (See under Cincinnati Society of Natural History.)

LINDGREN, W. (See under Interior Department, U. S. Geological Survey.)

LINDSAY, MRS. WM. (See under National Society, D. A. R.)

LITCHFIELD, ARCHIBALD, Braiden Town, Florida: Specimen of *Unio obesus*. 31470.

LITTLEJOHN, CHASE, Redwood City, California: Four eggs of Ancient Murrelet, *Synthliborhamphus antiquus*. 31651.

LOCHMAN, C. N., Bethlehem, Pennsylvania: Specimens of *Cytissus scoparius* and *Sisymbrium altissimum*. 31034.

LOCKE, OTTO, New Braunfels, Texas: Fifty specimens of *Tradescantia* and *Tinantia* 31940.

LONDON, ENGLAND: British Museum, transmitted by Dr. Henry Woodward: Two plaster casts of *Bison priscus* (gift) (31583); crabs, representing 9 species (exchange) and crabs, representing 2 species (lent) (31482.)

LONG, J. C., Jefferson, Maryland: Asbestos, from Jefferson, Frederick County. 30967.

LONG, M. E., Kansas City, Missouri: Copper pike found 3 miles east of New London, and a copper ax found 3 miles west of Ahnapee, Wisconsin. Exchange. 32245.

LOOMIS, L. M. (See under California Academy of Sciences.)

LOPER, S. WARD. (See under Wesleyan University.)

LORENZ, JOHN, Tremont, Pennsylvania: Large specimen of *Alethopteris sertii* (Brongn) Goepp, from Mammoth vein, Good Spring, Pennsylvania. 32099.

LORING, J. A., Department of Agriculture: Pair of Kootenay Indian moccasins, and a specimen of babiche of the Cree Indians. 31973.

LOWDERMILK, W. H. & Co., Washington, District of Columbia: Confederate edition of Braddon's "Lady Audley's Secret." Purchase. 30943.

LOWE, H. N., Pasadena, California: Marine invertebrates and crustaceans (31675, 31792).

LOWE, Dr. J. N., Milford, New York: Two specimens of *Smerinthus geminatus* Say. 32130.

LUCAS, F. A., U. S. National Museum: Crustaceans and ascidians from Pribilof Islands, 2 birds from Alaska, skulls and skeletons of seals, collected for the National Museum (31220, 31362, 31568).

LUNE, WILLIAM, Mathews Court House, Virginia: Herbarium specimen of *Filago germanica* L. 31137.

LYCETT, EDWARD, Atlanta, Georgia: A carved slab of North Carolina talc, the carved face coated with an iridescent glaze, supposed to be a reproduction of the ancient murrhine of the Romans. 31784.

LYONS, FRANCE: MUSEUM OF NATURAL HISTORY, L. Lartet, Director: Small collection of fishes. Exchange. 31540.

MCADOO, W. G., jr., New York City: Old-style pistol, supposed to have been carried by General Packenham at New Orleans. Returned. 31575.

MCCULLOCK, J., Sterling, Virginia: Native copper. 30838.

MCGEE, W J (See under Smithsonian Institution, Bureau of Ethnology.)

MCGREGOR, R. C., Palo Alto, California: Birds' skins from Colorado and California (31268, 31303, 31367).

McGuire, J. D., Ellicott City, Maryland: Polished stone implement (31609); carved pipe of serpentine found in Kentucky (31958). Deposit. (See under William D. Porter.)

McIlhenny, E. A., Averys Island, Louisiana: Twenty-six birds. 31120.

McKee, S. B., Mineville, New York: Specimens of zircon from Essex County. 31526.

McKesson & Robbins, New York City: Four specimens of drugs. 31825.

McMannen, Dr. C. T., White Springs, Florida, transmitted by Hon. S. Pasco, Unfinished Indian arrowhead found in a field near the Suwanee River. 32057.

MacMillan, C., Minneapolis, Minnesota: Two hundred and fourteen dried plants. Exchange. 31032.

McMillan, P. A., Banyan, Florida: Specimen of White-tailed Kite, *Elanus leucurus*. 31477.

Macoun, J., Geological Survey of Canada, Ottawa, Canada Plants from Pribilof and Bering islands. Gift and Exchange (31502, 31938, 32051).

Macoun, J. M., Geological Museum, Ottawa, Canada: Skeleton of a sea-otter. Exchange. 31916.

Manchester, England: Manchester Museum, Owens College, transmitted by William E. Hoyle, Keeper. Fifty-four species of Carboniferous fossils, illustrating a paper by Mr. H. Bolton, entitled "The Lancashire Coal Measures," and read before the New York Academy of Sciences. 32277.

Mansfield Memorial Museum, Mansfield, Ohio, transmitted by E. Wilkinson, curator: Insects, representing 24 species from Mexico. 31624.

Masius, A. G., Department of Agriculture: Specimen of *Thalesia uniflora*. 32111.

Marlatt, C. L., Department of Agriculture: Ninety specimens of Cynipidæ, representing 21 species. 31768.

Marsh, W. A., Aledo, Illinois: Unios (31298, 31410).

Marshall, George, Laurel, Maryland: Two plants collected for the National Museum. 32281.

Marshall, H. R., Laurel, Maryland: Specimen of *Sciurus hudsonius*. 32123.

Mason, Prof. O. T., U. S. National Museum: Steel engraving of a portrait of Benjamin Hallowel. 31630.

Masterman, E. E., New London, Ohio: Three photographs of a Great Horned Owl. 31448.

Matschie, Dr. Paul. (See under Berlin, Germany: Royal Zoological Museum.)

Matthew, Dr. G. F., St. John, New Brunswick, Canada: Two specimens of *Microdiscus schucherti* Matthew. 31424.

Maxwell, Hugh, St. George, West Virginia: Specimen of dust obtained by melting so-called "black snow" which fell in Tucker County. 31834.

Maynard, G. C. (See under Telegraphic Historical Society of North America.)

Mead, G. B., San Francisco, California: Eight birds' skins. 32178.

Meador, J. F., Phœnix, Arizona: Specimen of *Melittia gloriosa* H. Edwards. 31806.

Mearns, Dr. Edgar A., U. S. A., Fort Myer, Virginia: Nine herbarium specimens of *Tradescantia* and Umbelliferæ from Minnesota (30892); 6 specimens of *Peromyscus leucopus* and 2 crayfishes (30923); the feet of a Moose (*Alces machlis* = *Alce alces*) from Two Rivers, Minnesota (30925); 300 plants, fishes, 72 birds' skins, reptiles, insects, shells, mammal skins, marine invertebrates, and alcoholic birds from New York (31110); specimen of *Cypripedium parviflorum* (32216); collection of plants, birds' skins, reptiles, turtle, dry-land and fresh-water shells, birds, crustaceans, mammal skins, small collection of fishes from New York (31250); land, fresh-water shells and mollusks, representing 19 species, from New York (31312); reptiles and batrachians from Maryland and Virginia (31480); Unios from Fort Snelling, Minnesota, representing 2 species (31986); photograph of the discharge of David Niles, sergeant in the American Army, signed by George Washington and Jonathan Trumbull, jr., June 13, 1783 (32033); specimen of *Microtus pennsylvanicus* from the Smithsonian grounds (32142); snake and a tree-toad (32154).

Mearns, Master Louis di Zerega, Fort Myer, Virginia: Specimen of *Microtus pinetorum*, in the flesh (31538); 3 skins

MEARNS, Master LOUIS DI ZEREGA—C't'd. and skulls of *Microtus* and 3 skins and skulls of *Peromyscus* (31578).

MEDER, FERD, New York City: Book entitled "Verzeichniss von Photographien nach Werken der Malerei," Berlin. Purchase. 31805.

MEDFORD, H. C., Tupelo, Mississippi: Left valve of a specimen of *Unio multiplicatus*. 31822.

MEEK, Prof. S. E., care U. S. Fish Commission: Specimen of *Haliaëtus leucocephalus* from Idaho (31610); specimen of *Cariacus* (31619); collection of fishes from the Bay of Naples (32197).

MEEKER, GRACE, Ottawa, Kansas: Two specimens of *Daucus carota* and *Plantago lanceolata*. 30881.

MEINERT, Dr. F. (See under Copenhagen, Denmark: Zoological Museum.)

MEL, Miss NELLY, Glenwood, California: Specimen of *Hosackia glabra* Torr. 30862.

MELL, P. H., Auburn, Alabama: Eleven dried plants. Exchange. 31173.

MENCHINI, L., Washington, District of Columbia, transmitted by L. Amateis: Model in plaster of the Venus de Milo. 31189.

MERITT, Prof. J. W., Central Point, Oregon, transmitted by C. R. Biederman: Pipe found in a lava fort where General Canby was killed by the Modoc Indians. 31682.

MERRIAM, Dr. C. HART, U. S. Department of Agriculture: Photograph of a specimen of *Rhododendron catawbiense* (31922); 2 specimens of *Pseudotsuga mucronata*, from near Barclay, Utah (32094); 38 specimens of dried plants from Oregon (31232).

MERRILL, G. P., U. S. National Museum: Alcoholic specimen of Star-nosed Mole, *Condylura cristata*, from Orono, Maine (30924); 2 photographs of Italian women carrying coal (30944); geological material from Maine and California (30972); fresh and decomposed serpentine from Broad Creek Quarries, Harford County, Maryland (31062); specimens of argillite and residual clay from Peach Bottom slate quarries, Cambria, Maryland (31096); geological material from Frederick, Maryland (31152); fresh and decomposed soapstone from near Fostoria, Virginia (31275); fresh-

MERRILL, G. P.—Continued.
weathered and disintegrated dolomite from South Dover, New York (31753); 3 models of edged weapons from Upper India (gift) (31824); fresh and weathered limestone (marble) from Egremont, near Great Barrington, Massachusetts (31864). Collected for the National Museum. (See under Ericson Brothers.)

MERRILL, Dr. J. C., U. S. A., Fort Sherman, Idaho, transmitted by Major Bendire: Birds' skins, birds' eggs and nests from Idaho (30889, 31080, 31218).

MERRILL, L. H., Orono, Maine: Two photographs of Indian children. 32189.

MERRITT, W. A., Washington, District of Columbia: Eggs of *Corvus ossifragus* from District of Columbia. 31925.

METCALFE, JAMES, Silver City, New Mexico: Specimen of *Androsace occidentalis*. 31861.

MILLER, FANNIE, Mount Carmel, Pennsylvania: Pyrite with coal. 31617.

MILLER, Dr. G. A., Department of Agriculture: Specimen of *Obolaria virginica* from Maryland (32215); specimen of *Lycopodium inundatum* from Maryland (32285).

MILLS, R. A., Chuluota, Florida: Two reptiles from Florida, puparium of Rabbit Bot-fly, *Cuterebra cuniculi* (30912); 2 specimens of Sun-fish, *Eupomotis holbrooki* (31439).

MILLSPAUGH, C. F. (See under Field Columbian Museum.)

MINDELEFF, COSMOS, Washington, District of Columbia: Fire-sticks of Navajo Indians from San Juan, New Mexico. 30945.

MINNESOTA, UNIVERSITY OF, Minneapolis, Minnesota: Six plants from the United States and Europe (gift) (32225).

Herbarium of the University of Minnesota: 64 plants (exchange) (31998).

MISSOURI BOTANICAL GARDEN, St. Louis, Missouri, transmitted by Prof. William Trelease, director: Ten specimens of *Tradescantia* and allied genera. 31041.

MITCHELL, G. E. & C. W. RICHMOND, U. S. National Museum: Eighteen birds' skins from Nicaragua. 31769.

MITCHELL, Hon. J. D., Victoria, Texas: Larva of *Serphus dilatatus* and marine invertebrates (31030); land and fresh-water shells, representing 5 species

MITCHELL, Hon. J. D.—Continued.
from Texas (31171); transmitted by J. E. Benedict, toad (31524); mollusks, representing 4 species from Texas (31787); crustaceans, snake and toads (31804); 4 specimens of *Atta fervens* Say (32085); 7 specimens of Golden Tortois-beeetle, *Coptocycla aurichalcea* Fab. (32124); larvæ of *Thecla pœas* Hübner, lizard and a toad (32226).

MOHR, Dr. CHARLES, Mobile, Alabama: Nine plants from Alabama. 31113. (See under Agriculture, Department of.)

MOLONEY, Sir ALFRED, Belize, British Honduras, transmitted by C. A. Keffer: Rock containing fossil foraminiferæ (30933); specimens of gypsum and marble (31026).

MOORE, Mrs., Corning, New York, transmitted by U. S. Geological Survey: Specimen of *Dictyophyton tuberosum*. 31638.

MOORE, C. B., Philadelphia, Pennsylvania: Large burial-urn found on Ossabaw Island, Georgia. 31474.

MOORE, HETTIE A., Pasadena, California: Marine shells from California, representing 11 species. 30963.

MOORE, Mrs. L. D., Huntsville, Alabama: Piece of rock showing natural weathering from Monte Sana, near Huntsville, and two photographic views showing rocks *in situ*. 31846.

MORGAN, Dr. E. L., Washington, District of Columbia: Monkey and squirrel (31205, 32246).

MORGAN, H. DE. (See under J. de Morgan.)

MORGAN, J. DE., Gizeh Museum, Egypt, transmitted by H. de Morgan: Two hundred and fifty-two specimens, representing a series of prehistoric stone implements from Egypt. Exchange. 31407.

MORRELL, C. H., Pittsfield, Maine: Eggs of *Quiscalus quiscula æneus* and of *Corvus americanus*. 31718.

MORRILL, H. K., Gardiner, Maine: Specimen of *Centaurea nigra* and a specimen of *Digitalis ambigua* (30916); specimen of *Digitalis ambigua* (31103); dried plant (31276).

MORRISON, J. H., Luray, Virginia: Two hundred and twenty-one specimens of Trenton fossils. 32013.

MORTON, F. S., Portland, Maine: Specimens of worms, belonging to the Family Terebellidæ, and three specimens of *Pecten magellanicus* Gmel. 31894.

MOSS, WILLIAM, Ashton-under-Lyne, England: Photographs illustrating the anatomy of land-snails (32180); alcoholic specimens of *Anodonta cygnea* (32275).

MULLEN, B. H. (See under Salford, Lancashire, England; Royal Museum, Salford.)

MÜLLER, Baron FERD von, Melbourne, Australia: Plants. Exchange. (31088, 31040, 31266.)

MUMBRUE, D. P., Helena, Montana: Bones of a large Dinosaur, and a specimen of *Scaphites ventricosa* M. & H. 32047.

MUNDT, A. H., Fairbury, Illinois: Parasitic copepod taken from a carp. 32188.

MUSÉE D'HISTOIRE NATURELLE. (See under Geneva, Switzerland.)

MUSEUM OF COMPARATIVE ZOOLOGY, Cambridge, Massachusetts: Types of new species of crayfish, described by Mr. Walter Faxon. 30994.

MUSEUM OF NATURAL HISTORY. (See under Paris, France.)

NAMIYE, M., Zoological Institute, Science College, Imperial University, Tokio, Japan, through Dr. Leonhard Stejneger: Specimen of *Cicada leechi* Dist., described from China, and *Cicada flammata* Dist., described from Japan. 31490.

NATIONAL SOCIETY, Daughters of the American Revolution; transmitted by Mrs. William Lindsay: Autograph dinner invitation of Thomas Jefferson and a photograph showing folding of the same; a forty-dollar bill of the United Colonies, 1778, presented by Mrs. Eleanor Holmes Lindsay; letter of G. Brown Goode, dated July 3, 1896; engraved portrait of Israel Putnam, presented by his great, great granddaughter, Miss Emily N. Walker (32014); spinning wheel presented to the society by G. Brown Goode (32039)[1]; pewter plate,

[1] The wheel belonged to Dr. Goode's grandfather during the Revolutionary war, and suggested to him the design for the badge adopted by the Society in 1890.

NATIONAL SOCIETY—Continued.
one of a set from which bullets were made for use during the Revolutionary war, also 2 photographs of Mrs. Harriet Perry Stafford, of Cottage City, Massachusetts, who presented the plate to the society (31371); silver tea strainer owned by Wildred Washington, aunt of George Washington, shirt and mit worn by William Woodford at his christening about 1760, a candle from Yorktown, Virginia, and one from Germantown, Pennsylvania, in use during the Revolutionary war, letter of William Woodford dated Bethlehem, October 6, 1777, and a specimen of Continental money, eight dollars of the issue of 1775 (31488); china punchbowl of India ware that belonged to Col. R. H. Harrison, aid-de-camp to General Washington, presented by Elizabeth Sinclair Jones, and a china cup of India ware 150 years old, presented by Mrs. Stephen J. Field (31611.) Deposit.

NEBRASKA, UNIVERSITY OF, Lincoln, Nebraska; transmitted by Prof. E. H. Barbour: Five tablets of mounted small specimens of Dæmonelix, 2 specimens of Dæmonelix and 10 structural specimens of the same. Purchase. 31498.

NELSON, AVEN, Agricultural Experiment Station, Laramie, Wyoming: Thirteen specimens of Wyoming Umbelliferæ (gift) (31350); 125 specimens of dried plants (exchange) (31933). (See Agriculture, Department of.)

NELSON, E. W., Mexico, Mexico; transmitted by Mrs. N. M. Brown: Two hundred and seventy-five Mexican plants (purchase) (30898); 25 plants from Mexico (purchase) (30899); 213 Eskimo ethnological objects (purchase) (31796); 138 plants from Mexico (purchase) (31217); 21 Mexican plants (gift) (31648).) (See under Agriculture, Department of.)

NESMITH, H. M., Buffalo Gap, Texas: Oxidized septarian nodule. 32211.

NEVILLE, E. A., Austin, Texas: Egg of a white-necked raven. 31579.

NEW BRUNSWICK RED GRANITE COMPANY, Calais, Maine: Specimens of granite from Calais, and New Brunswick, Canada. 31849.

NEWHALL, W. H., U. S. National Museum: Specimen of *Cyanocitta cristata* from Falls Church, Virginia. 31953.

NEWSAM, FRANK, Mapleton, Illinois: Block of bituminous coal containing large fragments of mineral charcoal. Deposit. 30939.

NICHOLSON, Prof. H. A., University of Aberdeen, Scotland: Geological material from England and Scotland. 32141.

NIVEN & HOPPING, New York City: Badger skin and skull from Tulare County, California. Purchase. 31012.

NOBILI, JOSEPH. (See under Turin, Italy: Royal Zoological Museum.)

NORDSTRÖM, O. F., Punxsutawney, Pennsylvania: Two specimens of *Epeira fasciata*. 31807.

NORTH, H. N., Government Hospital for the Insane, Washington, District of Columbia: Four snakes (gift) (32251); drilled ceremonial object (deposit) (31450).

NOZAWA, S., Sapporo, Japan: Collection of reptiles, batrachians, and fishes from Yezo Island. 31755.

NUTT, DAVID, London, England: Ruxtorf's Rabbinical Bible, in two volumes. Purchase. 31132.

NUTTING, Prof. C. C. (Sea under Iowa, State University of.)

OGBURN, BURT, Phœnix, Arizona: Three pieces of cane or reed, and fragments of string or yarn found in a cave near Phœnix (31539); fragments of three shell-rings from Arizona (31742); specimen of painted pottery found on an ancient ruin in the Salt River Valley (31967).

OLDROYD, Mrs. T. S., Los Angeles, California: Six shells from San Pedro (31430); coral from California (31978).

OLDS, HENRY, Woodside, Maryland: Specimens of *Ammannia koehnei* and *Quercus palustris*. 31124.

OLMSTEAD, Mrs. S. H., care Prof. F. W. Clarke, U. S. Geological Survey: Poster of an early stage-coach used in the year 1821. 31702.

OLNEY, Mrs. M. P., Spokane, Washington: Shells, representing two species. 31629.

OREGON AGRICULTURAL COLLEGE, Corvallis, Oregon, transmitted by Prof. A. B. Cordley: Crab (*Pinnotheres*). 32266.

OSBORN, Dr. E. H., Kansas City, Kansas: Specimen of *Corydalus cornutus* Linn. 32271.

OSBORN, Prof. H., Ames, Iowa: Type specimens representing twenty species of hemiptera and homoptera. 31519.

OSBORN, Prof. H. L. (See under Hamline University.)

OSGOOD, W. H., Department of Agriculture. Skin of Marsh Wren from Arizona. 32034.

OSTERHOUT, G. E., New Windsor, Colorado: Plants (31960, 32071, 32121).

OXFORD, ENGLAND: OXFORD UNIVERSITY MUSEUM; transmitted by Dr. E. S. Goodrich: Cast of *Sphenodon punctatus*, and three casts of Stonesfield fossil mammals. Exchange. 31121.

PACKARD, R. L. (See under William Black.)

PALM, CHARLES, New York City: Twenty-seven specimens of coleoptera from Costa Rica. 31327.

PALMER, EDWARD, Washington, District of Columbia: Eight hundred and seventy Mexican plants (31710); collection of objects illustrating pulque making and the manufacture of pottery (31859). (See under Agriculture, Department of.)

PALMER, T. CHALKLEY, Media, Pennsylvania: Two specimens of dried plants from Maryland. 31422.

PALMER, WILLIAM, U. S. National Museum: Specimen of *Adelonycteris fuscus* (30968); specimen of *Vespertilio lucifugus* from Four Mile Run, Virginia (31020); two specimens of *Microtus* and a specimen of *Vesperugo carolinensis* (31043); waterproof cap made from Sea-lion gut, and a bag of gut from St. Paul Island, Bering Sea (31130); 16 mammals, representing 4 genera from Hampstead, King George County, Virginia (31356); two specimens of *Sciurus carolinensis* and a specimen of *Putorius noreboracensis* (31513); specimen of *Oceanodroma crystoleucura* from the District of Columbia (31752); 2 snakes and 3 lizards, mammals, land shells, 2 specimens of Lark Finch, *Chondestes grammaca*, from Nashville, Tennessee (32105); beetle, 2 spiders and a myriapod (32171); 9 reptiles and batrachians from Great Falls, Virginia (32182); 4 snakes and 2 frogs from Virginia. (32256.) Collected for the National Museum.

PAMMEL, L. H., Ames, Iowa: One hundred and one plants (gift) (31671); 212 plants (exchange) (32090).

PARET, T. D., Stroudsburg, Pennsylvania: Specimens of garnet from near New Hope, California. 31662.

PARIS, FRANCE: MUSEUM OF NATURAL HISTORY; transmitted by Prof. E. H. Bouvier: Crabs, representing 72 species. Exchange. 32112.

PARISH, S. B., San Bernardino, California: One hundred and nine specimens of dried plants (exchange) (31033); 100 dried plants (purchase) (31536); specimen of *Atriplex conpertifolia* (gift) (31745); specimen of *Phacelia tanacetifolia* (gift) (32070).

PARKER, E. W. (See under Savannah Mining Company.)

PARMENTER, C. S. (See under Baker University.)

PASCHAL, J. W., U. S. Pension Office, Washington, District of Columbia: Photograph of Maria Paschal, a Cherokee Indian girl. 31949.

PASCO, Hon. S. (See under Dr. C. T. McMannen.)

PATTERSON, ROSE, San Jose, California: Insects, consisting principally of hymenoptera. 31537.

PAUL, Col. AUGUSTUS C., National Soldiers' Home, Virginia: Sword, presented to Gen. Gabriel R. Paul by the citizens of St. Louis, Missouri, at the close of the Mexican war. Deposit. 31361.

PEABODY MUSEUM, Yale University, New Haven, Connecticut; transmitted by Prof. A. E. Verrill: Two crabs (*Lophoxanthus frontalis*) from California. Exchange. 31885.

PEARCE, C. W., Arcadia, Florida: Four mammal skins and 13 birds' skins from Florida. 31192.

PEARSON, W. H., Nutsford, near Manchester, England: Two hundred and ninety plants. Purchase. 31558.

PEEK, AMOS, Cedar Bluffs, Kansas: Specimen of *Cuscuta epithymum* Murray. 30919.

PERAK MUSEUM. (See under Larut, Perak, Straits Settlements.)

PERKINS, L., Baxter Springs, Kansas: Specimen of *Clitoria ternatea* L. 31203.

PHILADELPHIA ACADEMY OF SCIENCES, Philadelphia, Pennsylvania: Eleven herbarium specimens. 31724.

PHILLIPS, A. G., Johannesberg, Transvaal, South Africa: Garnets, obsidian, and zircon from Monastery Mine, Transvaal. 31523.

PHILLIPS, Dr. W. A., Evanston, Illinois: Stone implements illustrating the process of flaking. 31837.

PILSBRY, H. A., Academy of Natural Sciences, Philadelphia, Pennsylvania: Unios representing two species. 31018.

PINE, GEORGE, Aripeka, Florida: Specimens of *Polygyra* and *Cyrenoidea* (32059); shells representing three species from south Florida (32137).

PINKERTON, Mrs. S. E., Washington, District of Columbia: Copy of the "New York Herald" containing an account of the assassination of President Lincoln. Deposit. 32083.

PIPER, C. V., Seattle, Washington: Twenty-two specimens of Umbelliferæ (gift) (31194); 200 specimens of dried plants (exchange) (31326); 20 specimens of *Salices* (exchange) (31433).

POEY, F., Tampa, Florida: Larval cases of *Helicopsyche*, minerals, fresh-water, marine, and miscellaneous land-shells from Cuba, teeth and epidermis of a shark, portion of cranium and spine of a fish, skulls of 2 bats, 2 feet of a small mammal, corals, and fossils. Purchase. 31165.

POLLARD, C. L., U. S. National Museum: Plants (31238, 31416).

POLOCK, M., Philadelphia, Pennsylvania: Title-page, etc., of Aitken's New Testament. Exchange. 30995.

POPE, Capt. J. W., U. S. A., Bismarck, North Dakota: Fragment of a human skull found in an Indian mound. 31215.

PORTER, T. C., Easton, Pennsylvania: Two specimens of *Trillium* from Pennsylvania and New York. Exchange. 32239.

PORTER, W. D., Evanston, Illinois, transmitted by Hon. J. D. McGuire: Catlinite pipe-head from Wisconsin. 31231.

POWELL, Maj. J. W. (See under Interior Department, U. S. Geological Survey.)

PRENTISS, D. W., jr., Washington, District of Columbia: Dormouse (*Mus cardinus*) from Interlaken, Switzerland (gift) (31206); 10 moles from Germany (gift) (31209); 11 birds' skins from Dismal Swamp, Virginia (collected for the National Museum) (32263); long rawhide line and 12 squirrel traps from Point Hope, Alaska (collected for the National Museum) (32270); 9 mammal skins with skulls, 5 mammal skulls, hind foot of an opossum, part of a rodent, 3 young birds, specimen of *Cambarus blandingii* Erichson, shells, insects, sand, and water from the edge of Lake Drummond, birds' eggs and nest, 12 reptiles and batrachians, and fishes from the Dismal Swamp, Virginia (collected for the National Museum) (32274).

PRICE, R. H., College Station, Texas: Ten plants. 32210.

PRICE, W. W., Stanford University, California: Pair of Sierra Nevada Grosbeak, *Pinicola enucleator californica*. 32011.

PRINCE MANUFACTURING COMPANY, New York City: Raw and burnt ore from Bowman's, Prince, Pennsylvania. 31001.

PRINGLE, C. G., Charlotte, Vermont: Thirty-two type specimens of plants from Mexico (31507); 320 Mexican plants collected in 1896, 78 miscellaneous plants (31627). Purchase.

PRINGLE, H. N., Anoka, Minnesota: Concretions (31008); 8 specimens of *Inoceramus* from the Cretaceous formation (31027).

PROUDFIT, S. V., Washington, District of Columbia: Miscellaneous collection of stone implements from Virginia and the District of Columbia. 31774.

PROVINCIAL MUSEUM. (See under Victoria, British Columbia.)

PULLIAM, R. R., Lewisburg, West Virginia: Monkey-faced Yellow Spider, *Misumena rosea*. 30878.

QUEBEC, CANADA: CROWN LANDS, DEPARTMENT OF, transmitted by E. E. Tache, Assistant Commissioner: Two specimens of *Salvelinus oquassa marstoni* from Chenier Township, Rimouski County, Quebec. 31320.

RAILLIET, Prof. A., L'École Vétérinaire, Alfort, France: Parasitic worms consisting of specimens of *Stilesia centripunctata*, *Strongylus spathiger*, *Tænia cantaniana*, and *Fasciola hepatica* var. *angusta*. Exchange. 31457.

RALPH, Dr. W. L., Utica, New York: Five birds from the western section of the United States. Presented to the Smith-

RALPH, Dr. W. L.—Continued.
sonian Institution and deposited in the National Museum. 32007.

RAMBO, M. ELMER, Philadelphia, Pennsylvania: Specimen of *Corydalus cornutus* (30834); specimens of *Æschna heros* Fab. (32183).

RANDOLPH, P. B., Seattle, Washington: Land-shells, representing three species. 31786.

RANDOM, GILBERT, Hurley, Wisconsin: Sixty-one plants. 31083.

RANSDELL, J. W., Middletown, California: Specimen of *Buprestis lauta* Leconte. 32097.

RATHRAY, Rev. B. F., Washington, District of Columbia: Specimens of *Epiphragmophora fidelis*, from Puget Sound. 31518.

RECTOR, J., Washington, District of Columbia: Cell of Porter Wasp, *Eumenes fraterna* Say. 32249.

REGUA, Mrs. E. M., New York City: White metal miniature models of the Viking ship and the Santa Maria. 32115.

REID, C. H., Flagstaff, Arizona, transmitted by Dr. B. E. Fernow: Specimen of *Thaspialpestre*. 32035.

RENICK, A. B., Truckee, California: Mineral. 31139.

RETHERFORD, W. O., Tipton, California: Two-tailed lizard from California (31561); beetles—Ptinid and Dermestid—representing 2 species from California (31768); 19 beetles (32052).

REVERCHON, J., Dallas, Texas: Herbarium specimen of *Lactuca scariola* L. 30867.

RICE, Miss S. T., Worthington, Massachusetts: Specimen of *Gentiana crinita* (albino). 31228.

RICHARDS, ELIAS, New Orleans, Louisiana: Spade-like implement. Exchange. 31140.

RICHMOND, C. W., U. S. National Museum: Eighteen birds' skins from Nicaragua. 31769.

RICKSECKER, A. E., Oberlin, Ohio: Five hundred plants from Danish West Indies. Purchase. 31500.

RIDEOUT, B. S., Norway, Maine: Specimen of trap-dike in granite. Purchase. 31701.

RIDGWAY, ROBERT, U. S. National Museum: Carolina Paroquet from Florida (31173); Scarlet Tanager, *Piranga erythromelas* (31329); two specimens of American Crossbill, *Loxia curvirostra minor*, from Brookland, District of Columbia (31589).

RIDGWAY, Dr. T. E., Washington, District of Columbia: Autograph letter ter from General Washington to Quartermaster-General Greene, from Headquarters, Middlebrook, December 15, 1778, ordering that supplies be provided and deposited at Albany. Deposit. Returned. 31521.

RILEY, J. H., Falls Church, Virginia: Set of eggs of Broadwinged Hawk, *Buteo latissimus* (31178); set of eggs of White-breasted Nuthatch and an egg of Broadwinged Hawk from Virginia (31246); 10 birds' skins from Virginia (32026).

ROBERTSON, CHARLES, Carlinville, Illinois, transmitted by D. W. Coquillett: Thirteen specimens of North American diptera, representing types of nine species by Townsend and Coquillett. 30971.

ROBINETTE, F., Falls Church, Virginia: Nest of Parula Warbler, *Compsothlypis americana*, from Virginia. 32177.

ROBINETTE, G. W., Flag Pond, Virginia: Unios, representing seven species. 31208.

ROBINETTE, J. D., Flag Pond, Virginia: Unios from southwestern Virginia. (31013, 31051).

ROBINSON, Dr. B. L., Gray Herbarium, Cambridge, Massachusetts: Twenty-two fragments of plants, principally from Mexico. Exchange. 31211.

ROBINSON, Lieut. WIRT, U.S.A., Hubbard Park, Cambridge, Massachusetts: Albino Nighthawk, *Chordeiles virginianus*, from Virginia. 31153.

ROBINSON, W. R., Wingina, Virginia: Runt egg of Field Sparrow, from Nelson County. 31059.

ROCKHILL, Hon. W. W., Assistant Secretary of State: Korean idol obtained by Dr. H. N. Allen. Purchase. 31129. (See under Alfred E. Hippisley.)

ROOT & FIELD, Kilbourne, Illinois: Specimen of *Telea polyphemus* Cramer. 32150.

RORBBECK, C. G., Falls Church, Virginia: Eight reptiles from Virginia Beach. 31295.

ROSE, J. N., U. S. National Museum: Specimen of *Allamanda nerifolia* (30918); 2 specimens of *Hibiscus mutabilis* (31036); 30 plants (31354); specimen of *Agave* and a specimen of *Cooperia* (32198); 17 herbarium specimens from El Paso, Texas (32255). Collected for the Herbarium.

ROSE, O. G., San Rafael, California: Two skins of Nuttall's Woodpecker, *Dryobates nuttalli*. 31557.

ROTHROCK, THOMAS, Howard, Pennsylvania: Specimen of *Gillenia trifoliata* (31031); cocoon of Cecropia Silk-moth (31923); specimen of *Porteranthus trifoliatus* (32217).

ROYAL ACADEMY OF SCIENCE AND ARTS. (See under Barcelona, Spain.)

ROYAL MUSEUM. (See under Salford, Lancashire, England.)

ROYAL MUSEUM OF NATURAL HISTORY. (See under Berlin, Germany.)

ROYAL NATURAL HISTORY SOCIETY HOFMUSEUM. (See under Vienna, Austria.)

ROYAL ZOOLOGICAL MUSEUM. (See under Berlin, Germany.)

ROYAL ZOOLOGICAL MUSEUM. (See under Turin, Italy.)

RUBIN, C. A., Washington, District of Columbia: Insects (30947); mammals (30986, 31075).

RUFF, J. A., Cincinnati, Ohio: Galls of *Neuroterus saltatorius*. 30991.

RUMSEY, THOMAS, transmitted by Dr. G. Brown Goode: Pamphlet entitled "A short treatise on the application of steam," by James Rumsey of Virginia, printed in Philadelphia in 1788. Purchase. 31315.

RUMSEY, W. E., Morgantown, West Virginia: Specimen of *Capnoides flavulum*. 32058.

RUSBY, H. H., New York City: Two hundred and thirty-six Venezuelan plants (31003); 317 plants from Bolivia (30875); 74 specimens of Yucatan plants (31716). Purchase.

RUSH, R. C., Hudson, Ohio: Unionidæ (32267, 32299).

RUSH, Dr. W. H., U. S. N., League Island Navy-Yard: Land and fresh-water shells from the eastern coast of South America, representing about forty species, principally newly described or rare. Exchange. 32280.

RUSSELL, Prof. I. C., Ann Arbor, Michigan: Fresh basalt and residual soil from southeastern Washington. 31530.

RUTTER, Prof. CLOUD, Stanford University, California: Specimen of *Sequoia sempervirens* and a specimen of *Tumion californicum*. 31142.

RYDBERG, P. A., New York City: Two hundred and thirty-three plants from Montana (purchase) (31932); 5 specimens of Umbelliferæ (gift) (32110); 164 specimens of dried plants, collected by Mr. Flodman (purchase) (32173). (See under Agriculture, Department of.)

SABINE, G. W., House of Representatives: Twenty-one birds' skins from Nebraska. Exchange. 31400.

ST. JOHN'S COLLEGE. (See under Shanghai, China.)

SALFORD, LANCASHIRE, ENGLAND: ROYAL MUSEUM, Peel Park, England, transmitted by B. H. Mullen, curator: Ethnological and archæological objects. Exchange. 30865.

SANSHODO, New York City: Bronze Buddha, by Suzuki Chokichi and an alms bowl made of old bronze (31908); porcelain dog of Kutani ware (31937). Purchase. "N."

SARDESON, Dr. F. W., University of Minnesota, Minneapolis, Minnesota: Shakopee fossils, representing 2 species, and 21 specimens of St. Peter fossils, representing 9 species. Exchange. 31726.

SARGENT, C. S., Jamaica Plains, Massachusetts: Eighty-three plants. Exchange. 31721.

SAUNDERS, W. G., Newbridge, Oregon: Specimens of *Mantispa brunnea* Say, a neuropterous insect belonging to the family Hemerobiidæ. 31808

SAVAGE, M. A., New York City: Fire-syringe from Java (30845); collection of foreign matches (31372).

SAVANNAH MINING COMPANY, Dillsboro, North Carolina, transmitted by E. N. Parker: Corundum. 32117.

SAYERS, Mrs. J. D., Washington, District of Columbia: Collection of stone implements, shell ornaments, and fragments of human bones, found while excavating for ponds at the U. S. Fish Commission Station, San Marcos, Texas; fossils and mammal bones from the same locality. Exchange. 31778.

SCHAUPP, F. G., Shovel Mount, Texas: Two specimens of *Tradescantia*. 31996.

SCHINZ, Prof. Hans. (See under Zurich, Switzerland: Botanical Garden.)

SCHMID, E. S. Washington, District of Columbia: Serin Finch, in the flesh (31146); Paroquet from South America, in the flesh (31269); Paroquet, in the flesh (31271); 2 Canary birds (32080).

SCHNEIDER, LOUIS, Philadelphia, Pennsylvania: Collection of ivory clubs. Purchase. 31138.

SCHOENFELT, J. B., Douglas, Wyoming: Specimen of gypsum. 31010.

SCHÖNLAND, Dr. S. (See under Grahamstown, South Africa, Albany Museum.)

SCHUCHERT, CHARLES, U. S. National Museum: Collection of Oligocene fossils from Red Bluff, Mississippi (31230); Unios from Shubuta, Mississippi (31241); skeleton of *Dorudon* from near Dead Level, Alabama (31376); Claiborne shells (31377); *Zeuglodon* bones and Jackson formation shells (31378); geological material from Alabama (31385); *Zeuglodon* material and shells from near Fail, Choctaw County, Alabama (31449); boat-shaped object from near Rescueville, Alabama (31511); 200 herbarium specimens from Alabama and Mississippi (31647); Oriskany and Helderberg fossils from Tennessee (32166). Collected for the National Museum.

SCHUETTE, J. N., Green Bay, Wisconsin: Specimen of *Aster angustus* (Lindh.) T. & G. 32186.

SCHUMANN, Dr. K., Berlin, Germany: Three hundred specimens of Austro-African plants. 31862.

SCHWARZ, E. A., and H. G. HUBBARD, Department of Agriculture: Coleoptera, representing 69 specimens from North America (all new to the Museum collection). 31493.

SCIDMORE, Miss E. R., Washington, D. C.: Ninety-five photographs of views in Macao and Java, and 77 photographs of views in the vicinity of Hizen, Japan. 31224.

SCIENCE COLLEGE, IMPERIAL UNIVERSITY. (See under Tokio, Japan.)

SCOTT, GEORGE, Glen, Nebraska. Four teeth of a mastodon. Purchase. 31779.

SCOTT, GEORGE H., Sault Ste. Marie, Michigan, transmitted by E. S. Wheeler: Copper spearhead found on the banks of Bar River, Ontario, Canada. Purchase. 31095.

SCOTT, Prof. W. B., Princeton University, Princeton, New Jersey: Skeleton of a condor and 89 birds' skins, from Patagonia. Purchase. 32297.

SCUDDER, N. P., U. S. National Museum: Bat (*Nycticejus*) from Linden, Maryland. 30978.

SEATON-KARR, H. W., Atherton Grange, Wimbledon, Surrey, England: Two photographs of chipped implements from Somaliland, South Africa. 31522.

SELBY, A. D., Wooster, Ohio: Two dried plants. 31394.

SHANGHAI, CHINA: ST. JOHN'S COLLEGE, transmitted by Rev. F. L. Hawks-Pott, president: Eighteen objects illustrating Buddhistic worship. Exchange. 31156.

SHEAD, Mrs. E. E., Eastport, Maine: Specimen of *Leontodon autumnalis* L. 31221.

SHEAHAN, THOMAS, Batavia, Illinois: Seven specimens of *Calymene niagarensis* and one specimen of *Stromatopora*. 31727.

SHERIFF, D. T., Landover, Maryland: Barred owl, *Syrnium nebulosum*, in the flesh. 31375.

SHERMAN, C. A., Manville, Wyoming: Twenty-five modern scraper-blades used in dressing skins. 31686.

SHRIVER, HOWARD, Cumberland, Maryland: Eleven land snails (32106); specimen of *Sedum nevii* (30917).

SHUFELDT, Dr. R. W., Takoma, District of Columbia: Three specimens of *Holospira* and *Helix* from Texas. 32164.

SIGSBEE, Commander C. D., U. S. N., Washington, District of Columbia: Sea-lily, *Pentacrinus asterias*, from near Havana 31562.

SILTON, J. J., Pendleton, South Carolina: Specimen of *Thalessa lunator* Fabr. 32132.

SIMMER, HANS. (See under Kärnten, Austria: Tiroler Botaniker, Die Freie Vereinigung.)

SIMMS, C. N., Ronceverte, West Virginia: Two staurolite crystals, in the form of a cross, from Giles County, Virginia. 31857.

SIMPSON, T. L., Montgomery, Texas: Specimen of *Tinea pellionella* Linn. 32125.

SINCLAIR, S. (See under Sydney, New South Wales, Australian Museum.)

SKOW & GRIFFEN, Omaha, Nebraska: Hybrid Teal from Nebraska. Exchange. 31401.

SKREHOT, R. F., Kiajina, Texas: Specimen of *Canavalia*. 31547.

SLATER, Miss S. R., Philadelphia, Pennsylvania: Specimens of *Amherstia nobilis* and other seeds, from Burmah. 32068.

SMALL, J. K., New York City: Two specimens of dried plants from South Carolina and China (gift) (31421); 51 specimens of mosses of the southern section of the United States (purchase) (32036); 60 lichens (purchase) (32221).

SMITH, Mrs. A. M., Minneapolis, Minnesota: Twenty specimens of colonial and continental paper money. Purchase. 31918.

SMITH, EUGENE, Hoboken, New Jersey: Specimen of *Varanus arenarius* from North Africa. Exchange. 31462.

SMITH, HARLAN I., New York City: Specimen of *Apus aequalis* Packard, from New Mexico. 31441.

SMITH, Dr. H. M. (See under J. S. Wilson.)

SMITH, Prof. J. B., Rutger's College, New Brunswick, New Jersey: Fourteen specimens of *Lachnosterna*. Lent. Returned. (30908); 10 specimens, including 7 type specimens of noctuid moths, from Colorado and British America. (32199).

SMITH, J. SHIRLEY, Shelby, North Carolina: Specimen of muscovite. 32024.

SMITH, L. H., Easton, Maryland: Royal Walnut moth, *Citheronia regalis*. 30905.

SMITH, Rev. LUCIUS C., Department of Agriculture: Plants from Mexico, representing fourteen species. 31053.

SMITHSONIAN INSTITUTION, Mr. S. P. Langley, Secretary:

Emerald crystal in calcite from Muso Mine, Colombia. Addition to the "Lea Collection." 31225.

Bronze medal commemorative of the sesqui-centennial of the College of New Jersey and the inauguration of Princeton University. Presented to the Smithsonian Institution by the Trustees of Princeton University and deposited in the National Museum. 32030.

Transmitted from the Bureau of Ethnology, Maj. J. W. Powell, Director:

Copper hawk-bell, taken from a mound in Tonto Basin, Arizona (30857); note of Bank of Cincinnati, issue of 1818 (30961); 172 stone implements from near Kutztown, Pennsylvania, and a specimen of mineral from the same locality, obtained by Mr. H. K. Deisher (31133); natural history specimens and ethnological objects collected by Dr. Fewkes in Arizona and New Mexico, 1896 (31151); 2 skins of *Cariacus virginianus* from Maine, with skull (31437); plants and a specimen of *Bufo punctatus*, collected by Mrs. Matilda C. Stevenson in Pueblo County (31599); specimen of sandstone, with a cup-like depression, from Winifrede, West Virginia (31642); collection of archæological objects obtained by Prof. G. K. Gilbert in Colorado (31683); 13 photographs of Eskimos in costume (31737); 2 potsherds obtained by Dr. F. S. Bulmer from the adobe walls of an early Spanish monastery near Casas Grandes, Chihuahua, Mexico, and a fragment of obsidian from the neighboring mountains (31803); the Hilder collection of antiquities from mounds in Missouri and Illinois (31883); collection of ethnological objects from Zuñi, collected by Mrs. M. C. Stevenson (31983); collection of mat-makers' appliances and products obtained from the Musquaki Indians, Iowa, collected by W J McGee (32138); sling or bolas used in taking water-fowl by the Eskimo of Arctic Alaska, collected by Marcus Baker near Icy Cape (32250); objects used in connecnection with the Ghost Dance of the Kiowa Indians (32272); shinney-stick, a set of four gaming-tubes, and a set of three gaming-sticks, collected by S. T. Dozier, Espanola, New Mexico (32288). (See under W. S. Blatchley.)

SMITHSONIAN INSTITUTION—Continued.
Transmitted from the National Zoological Park, Dr. Frank Baker, Superintendent:
Civet Cat, *Bassariscus astuta*, and Peccary (*Dicotyles tajacu*) (30848); Iguana (30883); 2 specimens of *Macacus rhesus*, a specimen of *Ateles ater*, 2 specimens of lynx, and a specimen of *Erethizon* (30970); Clark's Nutcracker, *Nucifraga columbiana*, from Montana, in the flesh (31023); specimen of puma (31128); Clark's Nutcracker, *Nucifraga columbiana*, in the flesh (31145); porcupine (*Erethizon epixanthus*) in the flesh (31207); 2 specimens of *Phoca vitulina* (31280); specimen of *Pavo cristatus*, in the flesh (31299); specimen of *Phalangista*, from Sydney, New South Wales (31398); Eskimo dog (*Canis familiaris*) (31413); specimen of *Phoca vitulina*, in the flesh (31414); 4 birds, in the flesh, from Montana and District of Columbia (31677); specimen of *Dicotyles tajacu*, specimen of *Neotoma cinerea*, and specimen of *Felis pardalis* (31692); specimen of American Magpie, *Pica pica hudsonica*, in the flesh (31882); specimen of *Macacus rhesus* (31903); Golden Eagle and an African Gray Parrot, in the flesh (31921); snake from Florida (32015); snake (32016); snake from Blue Ridge Mountains (32017); Iguana (32018); snakes from Kansas and Oregon (32019, 32020, 32021, 32022); specimen of *Urocyon virginianus* from Winchester, Virginia (32128).

SMOUT, Mrs. T. J., Wood River, Nebraska: Photograph of signatures of members to "Non-Importation Association" in the Continental Congress, October 20, 1774. 31848.

SMUGGLER UNION MINING COMPANY, Telluride, Colorado, N. T. Mansfield, Superintendent: Specimen of silver ore from the Mine. 31590.

SNYDER, Dr. D. W., Nashville, Tennessee: Collection of ethnological objects from Africa, including model of a Mukete house, and a very interesting collection of beetles from the interior of Africa. 31155.[1]

SNYDER, Dr. F. D., Gaines, New York: Five birds' skins from New York. Exchange. 31495.

SNYDER, J. O., Stanford University, California: Collection of reptiles and batrachians, 18 birds' skins, invertebrates, insects, representing about 140 specimens, and a specimen of *Thomomys bottæ*. Exchange. 31776.

SORIN, T. R., Bisbee, Arizona: Sheet stalactite from Copper Queen Mine. Purchase. 30952.

SPAINHOUR, J. M., Lenoir, North Carolina: Specimen of *Attacus cecropia* Linn. 32060.

SPATZ, P. W. H., Gabes, Tunis, Africa: Alcoholic specimen of *Ctenodactylus massoni*. Purchase. 31193.

SPENCE, R. S., Montpelier, Idaho. Ten specimens of Middle Cambrian trilobites and a piece of rock containing *Corbula* from the Bear River group (Upper Cretaceous). 31108.

SPENCER, A. L., Oenaville, Texas: Beefly, *Bombylius lancifer* Osten Sacken, and a Wasp (*Chrysis clara*) Cresson. 32208.

SPRINZ, BARNARD, New Albany, Indiana: Seven pottery pipes (31202); 3 clay tobacco-pipes (31606).

SPURR, J. E., U. S. Geological Survey: Specimen of cinnabar (crystallized), and two specimens of scorodite with realgar from Mercur Mine, Mercur, Utah (31291); tooth of a mammoth (31307). (See under Interior Department, U. S. Geological Survey.)

STAHL, E. M., Glenville, Pennsylvania: Four plants. 32136.

STANFORD, A. W., Lowell, Massachusetts: Thirty-four ferns from China and Japan. Purchase. 32235.

STANLEY, D. T., Des Moines, Iowa, transmitted by Charles Aldrich: Polished stone implement (patu-patu) found on the bank of Rogue River, Oregon. Purchase. 32159.

STANTON, L. H., Boulder, Colorado: Four specimens of altaite (lead telluride) from Inter Ocean Mine, Sunshine, Colorado. 30844.

STANTON, T. W., U. S. Geological Survey: Fossil fly (31162); nest of *Anthophora maculifrons* Cresson, found in a

[1] The insects, which were collected at Luebo, Congo, are the first specimens received from the interior of Africa.

STANTON, T. W.—Continued. specimen of sandstone from New York. (31475.)

STARIN, Col. J. H., New Rochelle, New York: Macaw, in the flesh. 31573.

STEARNS, ELMER, Salt Lake City, Utah: Specimen of *Thalesia fasciculata*. 32236.

STEARNS, Dr. R. E. C., Los Angeles, California: Specimen of infusorial earth, fire-clay, insects, shells. 32028.

STEELE, E. S., Department of Agriculture: Plants and grasses. (31333, 31503, 31685.)

STEINER, Dr. ROLAND, Grovetown, Georgia: Large collections of archæological objects from an ancient village site on Kiokee Creek, Columbia County, Georgia: (30938, 30976, 31050, 31235, 31237, 31258, 31311, 31313, 31347, 31484, 31497, 31541, 31931, 32214.)

STEITZ, ADAM, Baltimore, Maryland: Specimen of *Pogonia ophioglossoides* (30871); five specimens of dried plants (30956).

STEJNEGER, Dr. L., U. S. National Museum: Fifteen plants from Kurile Islands (31577); miscellaneous insects from Pribilof Islands, Commander Islands, Japan, Hawaii, and Robben Island, representing about 20 species, reptiles and batrachians, mollusks from Bering Island, fossil vertebrates, fossil plants, fish from Paratunka River, Kamchatka, crustaceans and worms from the Sandwich Islands, birds' skins from Kurile Islands, plants, skulls of mammals (31801); specimen of *Lampropeltis rhombomaculatus* from Brookland, District of Columbia (32153). Collected for the National Museum. (See under H. W. Henshaw; M. Namiye.)

STEPHENS, F., Witch Creek, California: Bats (gift and exchange) (31919, 32053).

STERKI, Dr. V., New Philadelphia, Ohio: Specimens of *Piscidia*, representing 8 species from the United States, and 3 specimens of *Palæmonetes exilipes* Stimpson. 31323.

STEVENS, S. G., Lincoln, New York: Squirrel, in the flesh. 31195.

STEVENSON, Prof. J. J., New York University, New York; folded gneisses from University Heights, New York, and "asbestos" from Tilly Foster Mine, New York. 32276.

STEVENSON, Mrs. M. C. (See under Smithsonian Institution, Bureau of Ethnology.)

STEWART, Dr. T. B., Lock Haven, Pennsylvania: Five photographs of archæological objects. Exchange. 31046.

STOTLEY, GEORGE. (See under Agriculture, Department of.)

STOLZMAN, Prof. JEAN. (See under Varsovie, Russia: Branicki Museum.)

STOUT, WILBUR, Sciotoville, Ohio, transmitted by Dr. G. W. Girty, U. S. Geological Survey: Four small hatchets or chisels, and a fragment of a pendant, or sinker, of hematite, 24 specimens of *Conostychus ornatus* Lesq., 6 specimens of *Conostychus prolifer* Lesq., and 5 specimens of *Asterphycus*, species undetermined (31373); 50 specimens of *Conostychus*, 19 specimens of Upper Waverly fossils, and 14 specimens of fire-clay (31443).

STRAITS SETTLEMENTS. (See under Larut, Perak, Perak Museum.)

STRANAHAN, JULIUS, Keeseville, New York: Specimen of titanic iron. 32254.

STRANAHAN, J. W., Fort Lauderdale, Florida: Photograph of families of Pine Island Indians from New River, Florida, and wooden spoons and ball rackets with a description of the game, obtained from the Seminole Indians (gift) (31383); complete costume of a Seminole Indian chief (purchase) (31509); 2 complete costumes worn by Seminole women (purchase) (32064).

STRONG, Miss L. A., Greeley, Iowa: Tineid-moth, *Tinea pellionella* Linn., and clusters of cocoons of *Apanteles glomeratus* L. 32162.

SUKSDORF, W. N., White Salmon, Washington: Plants. (30893, 31582.)

SULLIVAN, G. N., Washington, District of Columbia: Albino Song Sparrow, *Melospiza fasciata*. 31690.

SURBER, THADDEUS, White Sulphur Springs, West Virginia: Two specimens of *Spermophilus tridecemlineatus* from Statesbury, Missouri. 31287.

SUTOR, HENRY, Christchurch, New Zealand. Unios from New Zealand and Tasmania (gift) (31254; Unio from New Zealand (gift)(31381); 3 alcoholic specimens of Unios from New Zealand, and

SUTOR, HENRY—Continued.
Unio shells (exchange) (31581); 2 specimens of *Unio legrandi* from Tasmania (gift) (31812).

SWAN, J. G., Port Townsend, Washington: Specimen of *Pecten caurinus* from Fuca Strait. 31442.

SWINHOE, ERNEST, Oxford, England: Sixty-five specimens of lepidoptera, representing 52 species from the East Indies, illustrating mimicry and protective resemblance. Purchase. 31868.

SWORD, J. F., Jonesville, Virginia: Unionidæ, representing fourteen species, from Lee County, Virginia. 30974.

SYDNEY, NEW SOUTH WALES: AUSTRALIAN MUSEUM, transmitted by S. Sinclair, secretary: Fishes, mollusks, reptiles, 25 birds' skins, minerals, ores, and rocks. Exchange. 31081.

SYLVESTER, E. O., Sitka, Alaska: Plant. 31851.

TACHE, E. E. (See under Quebec, Canada: Crown Lands, Department of.)

TASSIN, WIRT, U. S. National Museum: Specimens of monazite sand from Burke County, North Carolina (31290); 11 specimens of calamine from Bertha Mine, Pulaski, Virginia (31292); minerals from Stassfurt, Germany, consisting of rock salt, kainite, schönite, and others (31293); 158 specimens of minerals from Sussex County, New Jersey, and Orange County, New York, including spinel, fowlerite and others (31300); 4 specimens of millerite from Gap Mine, Lancaster County, Pennsylvania (31304); 9 specimens of minerals (31318); a set of 5 models illustrating the dispersion of optic axes in minerals (31388); specimen of gersdorffite from Alova, Malaga, Spain (31889).

TAYLOR, Miss EVELYN, Tiverton, Rhode Island: Lower pharyngeal bone of a Blackfish (*Tautoga onitis*). 31847.

TAYLOR, J. G., Owensboro, Kentucky: Archæological objects from Corn Island, Spencer County, Indiana, and an unfinished ceremonial object from Daviess County, Kentucky. Deposit. Returned. 30960.

TAYLOR, Miss KATHERINE A., Baltimore, Maryland: Six herbarium specimens of *Commelina communis* from Baltimore County. 31403.

TEN EYCK, Miss D., Worcester, Massachusetts: Land snail. 31321.

TEFFT, Dr. F. O., Tecumseh, Michigan: Two Green-sided Darters *Diplesion blennioides*. 32265.

TELEGRAPHIC HISTORICAL SOCIETY OF NORTH AMERICA, transmitted by G. C. Maynard, Secretary: Collection of Morse telegraphic apparatus (31175); piece of submarine cable laid in 1853, a specimen of the submarine cable laid in 1866, and two glass insulators (31545). Deposit.

TELLERY, S. J., New York City: Tibetan brass trumpet. Purchase. 30965.

TERRELL, J. A., Bloomfield, Kentucky: Screech Owl, in the flesh (31122); specimens of *Megascops asio*, in gray plumage, in the flesh (31317).

TEST, F. C., Lafayette, Indiana: Three snakes. 32223.

THAYER, A. H., Dublin, New Hampshire: Snake (30854); 15 birds from Europe (32176).

THOMPSON, Prof. D'ARCY W., Dundee, Scotland: Crustaceans. 31639.

THOMPSON, H. D., Moline, Illinois: Pottery whistle shaped like an animal's head, and a small flint scraper. 32264.

THOMPSON, M. T., Providence, Rhode Island: Hemiptera, representing four species. 31814.

THOMPSON, Mrs. W. W. (See under Agriculture, Department of.)

THORNE, E. J., Findley, Maryland: Nest of Ruby-throated Humming-bird, *Trochilus colubris*. 30914.

THORPE, Dr. H. H., Liberty Hill, Texas: Two alcoholic snakes (30864); 2 specimens of *Scolopendra heros*, and a Tarantula (31257).

TIFFANY, C. L., New York City: Vase of favrile glass. 30951.

TIFFANY & CO., New York City: Collection of engraved diplomas, inscriptions, etc., made by the company (gift) (31143); specimen of rhodochrosite from John Reed Mine, Alecante, Lake County, California (purchase "N") (31797); gold and silver specimens (purchase "N") (31899); native silver from Batopilas, Mexico (purchase "N") (31905); 6 specimens of Copenhagen porcelain, consisting of a faïence figure of an owl, 2 faïence pitchers, and 11 pieces of Russian iron art castings (purchase) (31936).

TILDEN, JOSEPHINE E., University of Minnesota, Minneapolis, Minnesota: Marine and fresh-water algæ, representing 100 species. Purchase. 31620.

TINSLEY, J. D., Agricultural College, Mesilla Park, New Mexico: Two specimens of *Philadelphus microphyllus*. 31392.

TIROLER BOTANIKER, DIE FREIE VEREINIGUNG. (See under Kärnten, Austria.)

TISDALL, A. J. (See under Agriculture, Department of.)

TODD, Prof. D. P. (See under Amherst College Observatory.)

TOKYO, JAPAN, SCIENCE COLLEGE, IMPERIAL UNIVERSITY, transmitted by Dr. I. Ijima: Two petrels (31817); reptiles and batrachians from Japan (32118).

TOLLIN, OSCAR, Planter, Florida: Skeleton of Blackfish (*Globicephalus brachypterus*) and 3 additional skulls of the same species. Purchase. 31438.

TOMEY, J. W. (See under Agriculture, Department of.)

TOPPING, D. L., Washington, District of Columbia: Nine specimens of *Pespedeza* (exchange) (31658); specimen of *Bœhmeria cylindrica scabra* (31694).

TOWER, G. W. (See under Interior Department, U. S. Geological Survey.)

TOWNSEND, C. H., U. S. Fish Commission: Three alcoholic specimens of *Menopoma alleghaniensis* from Westmoreland County, Pennsylvania (31267); skin of *Phoca largha* (31363); reptiles from Lower California (31819).

TOWNSEND, C. H. TYLER. (See under Agriculture, Department of.)

TRACY, S. M., Agricultural College, Mississippi: Seven herbarium specimens (30879); specimen of *Solanum rostratum* (31148).

TRAPHAGEN, F. W., Montana College of Agriculture, Bozeman, Montana: Two specimens of sapphire corundum in the matrix from 8 miles west of Gallatin River, Montana. 31183.

TRELEASE, Prof. WILLIAM, St. Louis, Missouri: Specimen of *Isœtes nuda*. 31655. (See under Missouri Botanic Garden.)

TREASURY DEPARTMENT, U. S.:

Bureau of Engraving and Printing, C. M. Johnson, Director: Portraits of Franklin, Henry, Morse, and Kendall. 31357.

Life-Saving Service, transmitted by Capt. C. J. Dunton, Keeper, Ocean City, Maryland: Partially decayed specimen of Angler, or Fishing-frog, *Lophius piscatorius*. 31399.

TREAT, W. E., Silverlane, Connecticut: Mammal skins and skulls (31591); mammal skins and skulls and 4 skins of Sharp-tailed Sparrow, *Ammodramus caudacutus* (31700). Exchange.

TRIBOLET, Mrs. M. A., Deruyter, New York: Twenty-two ethnological objects from Burma and China. 32074.

TRING, ENGLAND: Tring Museum Specimen of *Mixornis everetti*, and a specimen of *Conurus xanthogenis*. Exchange. 31302.

TRISTÂN Señor J. FID. (See under Costa Rica, Museo Nacional, de.)

TROSTLER, I. S., Omaha, Nebraska: Birds' skins and eggs. Exchange. 31835.

TRUE, F. W., U. S. National Museum: Basket cradle obtained from the Conox Indians, Vancouvers Island. 31951. Collected for the National Museum.

TSCHUSI VON, VICTOR RITTER ZU SCHMIDHOFFEN, Hallein, Hungary. Seventeen birds' skins from Europe. Exchange. 31073.

TUCKER, Mrs. L. M., Ortonville, Michigan: Pieces of a human skull and fragments of pottery from a mound in Groveland, Michigan. 31666.

TURIN, ITALY: ROYAL ZOOLOGICAL MUSEUM, transmitted by Mr. Joseph Nobili: Crustaceans, representing 10 species (31464); decapod crustaceans, representing 24 species (32224). Exchange.

TURNER, H. W., U. S. Geological Survey: Two specimens of pyrophillite from East Tres Cerritos, California. 31406.

TWOMEY, GEORGE, Jeffersonville, Indiana: Human bones found in an Indian grave, and also on the Falls of the Ohio River. Presented to the Smithsonian Institution and deposited in the National Museum. 31263.

ULKE, HENRY, Washington, District of Columbia: Thirty-eight moths from Monterey, Maryland. 31259.

UNDERWOOD, L. M., Auburn, Alabama: Six ferns from Alabama (30882); 5 speci-

UNDERWOOD, L. M.—Continued. mens of *Arisæma triphyllum* (31074); specimen of *Trillium underwoodii* Small (32184).

VAN DENBURGH, JOHN, San Francisco, California: Specimen of *Sceloporus licki* from Lower California. 31856.

VAN DEUSEN, Mrs. ALYS BATES, Hartford, Connecticut: Collection of china plates, pitchers, and other objects illustrative of American history (31465, 31552); 3 pieces of pottery (31593); 5 pieces of pottery (31594); collection of china plates (31611); 3 pieces of pottery (31670). Deposit.

VAN GAASBEEK & ARKELL, New York City: A reclining Buddha, 2 bronze Buddhas, Buddha, a kishnu, bronze idol, and model of a mosque (purchase "N") (31914); oriental standing-lamp (purchase) (31952).

VAN HISE, C. R., Madison, Wisconsin: Jaspalite from Negaunee formation of Lower Marquette series. 32278.

VAN HYNING, T., Des Moines, Iowa: One hundred and twenty-two specimens of land, fresh-water, and marine shells from various localities, and a cluster of barnacles from Portland, Oregon. 32067.

VAN KIRK, J. W., Potts Grove, Pennsylvania: Fossils and archæological objects from Northumberland County. Exchange. 31297.

VAN RENESSELAER, A. CORTLAND, Stockbridge, Massachusetts: Mezzotint of the late Dr. Archibald Bruce, of New York City. Presented to the Smithsonian Institution and deposited in National Museum. 32093.

VANIZ, Dr. G. W. Smith, Weather Bureau, Canton, Mississippi: Isopod (*Armadillidium vulgare*). 31740.

VARSOVIE, RUSSIA: BRANICKI MUSEUM, transmitted by Prof. Jean Stolzman: One hundred and fifty-two birds' skins from Peru and Transcaspia. Exchange. 32231.

VAUGHAN, T. WAYLAND, U. S. Geological Survey: Shells from the drift in Texan rivers. 31966. (See under Interior Department, U. S. Geological Survey.)

VERRILL, Prof. A. E. (See under Peabody Museum.)

VICTORIA, BRITISH COLUMBIA: Provincial Museum, transmitted by John Fannin: Ninety-seven birds' skins from British Columbia (31158); 6 Crows (31415). Exchange.

VIENNA, AUSTRIA: ROYAL NATURAL HISTORY SOCIETY HOFMUSEUM: One hundred plants. Exchange. 31355.

VINTON, H. A. & F. H., Bedford Village, New York: Spinet made by Joseph Mahoon, London, probably in the seventeenth century. Deposit. 32205.

VON STREERUWITZ, W. H., Austin, Texas: Geological material. 31510.

WAGNER FREE INSTITUTE OF SCIENCE, Philadelphia, Pennsylvania: Two species of *Arca*, types of W. Wagner. 31887.

WALCOTT, Mr. C. D., Director U. S. Geological Survey: Gold-bearing quartz and other material from Red Mountain and Silver Peak Districts, Nevada. 32045.

WALKER, BRYANT, Detroit, Michigan: Two specimens of *Cychrus andrewsii* from Roan Mountain, North Carolina; shells, representing 4 species (31024); Unionidæ, representing 3 species from the eastern section of the United States (31094); fresh-water shells from the Philippine Islands, representing 3 species (32087).

WALKER, WYTHE, Victor, California: Specimen of *Serphus dilatatus*. 31990.

WAR DEPARTMENT, U. S.: Signal Office, Gen. A. W. Greely, Chief Signal Officer: Beardslee Magneto-dial telegraph instrument. Deposit. 31944.

WARD, H. A., Rochester, New York: Geological material. Purchase. 30953.

WARD'S NATURAL SCIENCE ESTABLISHMENT, Rochester, New York: Eleven trilobites (purchase) (31698); 7 parrots from various localities (purchase "N") (31704); cast of specimen of *Asaphus gigas* (purchase "N") (31720); 3 parrots (purchase "N") (31741); mammal skins (purchase "N") (31744); fossil crinoids (purchase "N") (31756); 4 specimens of Cambrian trilobites (purchase "N") (31758); anatomical models and limbs (purchase "N") (31780); 13 fossil fishes (purchase "N") (31793); skull of a crocodile (purchase "N") (31872); itacolumite from Agra, India (exchange) (31895); gold and silver specimens (purchase "N") (31896);

WARD'S NATURAL SCIENCE ESTABLISHMENT—Continued.
crustaceans (purchase) (31981); 5 Japanese sponges (purchase) (31982); skeleton of Gangetic crocodile (purchase) (32005); cast of a head of a small Right whale (purchase "N") (32006); miscellaneous collection of land, fresh-water, and marine shells from various localities (purchase "N") (32054); skeleton of a native Australian (purchase "N") (32155).

WARD, Prof. LESTER F., U. S. Geological Survey: Seventy-seven herbarium specimens from Kansas and Oklahoma (31358); 18 plants from South Carolina (32037); specimen of *Trifolium hybridum* (32172); specimen of *Lonicera japonica* from District of Columbia (32237).

WARDEN, JACOB, Berryville, Virginia: Red Bat, *Atalapha borealis*. (30958.)

WARMING, Dr. E., Director, Botanical Museum, Copenhagen, Denmark: Six hundred plants. Exchange. 31980.

WASHINGTON, H. S., Locust, New Jersey: Forty-two volcanic rocks from Italy, a stone ax from Ben Hassan, on the Nile, Egypt, and a hammer stone of gabbro, from Heraion, Argos, Greece. Exchange. 30911.

WATSON, J. M., Rose Normal Academy, Martins Mills, Tennessee: Chipped flint hatchet found near Martins Mills. 30950.

WAYCHOFF, A. J., Waynesburg College, Waynesburg, Pennsylvania: Portion of the skeleton of a child taken from a grave. 31364.

WAYNE, ARTHUR T., Mount Pleasant, South Carolina: Four birds' skins, representing 4 species from South Carolina and Mexico (exchange) (30852); 3 birds' skins (exchange) (30906); 12 birds' skins from South Carolina (exchange) (31273); 6 birds' skins (exchange) (31296); 9 specimens of Sharp-tailed Sparrow and a King Rail (exchange) (31344); specimen of Pine Siskin (*Spinus pinus*) and Leconte's Sparrow (*Ammodramus lecontei*) from South Carolina (gift) 31920); 6 Seaside Finches (purchase) (31970); 2 birds' skins (gift)(32202); 11 birds' skins from South Carolina (exchange) (32203); 5 specimens of *Ammodramus* (purchase) (32229); 2 specimens of Henslow's Sparrow (exchange) (32243).

WEBB, C. H., New York City: Two specimens of Dog Beetle, *Galerucella xanthomelæna* Schrank.

WEBB, DE WITT, St. Augustine, Florida: Five negatives and 4 prints of a giant cephalopod (gift) (31572); sections of muscular envelope of *Octopus giganteus* Verrill (purchase) (31678); minnows, and specimens of *Cyprinodon variegatus* (gift) (31850).

WEBB, W. F., Albion, New York: Great Blue Heron from Florida (gift) (30890); 3 shells (exchange) (31459).

WEBBER, H. J., Eustis, Florida: Specimen of *Juncus marginatus*. 31216.

WEBSTER, Prof. F. M., Wooster, Ohio: Type specimen of *Apanteles orgyiæ* Ashm. 32151.

WEED, W. H. (See under Interior Department, U. S. Geological Survey.)

WENZEL, H. W., Philadelphia, Pennsylvania: Eight specimens of *Anthonomus latiusculus* and *Anthonomus nigrinus* (gift) (31223); 36 specimens of coleoptera, representing 7 species (exchange) (31366).

WESLEY, WILLIAM & SON, London, England: Bible, Genevan version, 1577, and a Latin Bible, printed in Nuremburg in 1478. Purchase "N." 32089.

WESLEYAN UNIVERSITY, Middletown, Connecticut, transmitted by Prof. S. Ward Loper: Minerals, and 81 beetles, representing 40 species, principally obtained from the Cape of Good Hope. Exchange. 32213.

WESTERN UNION TELEGRAPH COMPANY, New York City, transmitted by T. T. Eckert: Nineteen samples of various types of Atlantic cables laid since 1858, up to the present time (gift) (31262); the original receiving telegraph apparatus made by Prof. S. F. B. Morse, lead type for Morse's telegraph, patent to Morse, reissue No. 117, June 13, 1848, signed by James Buchanan, Secretary of State, and Edmund Burke, Commissioner of Patents (deposit) (31286); 18 pieces of telegraph apparatus (deposit) (31652).

WETHERBY, A. G., Magnetic City, North Carolina: Unios from the United States, representing 3 species (31028); 119 specimens of dried plants (31312).

WHEELER, C. F., Agricultural College, Michigan: Specimen of *Plantago* L.,

WHEELER, C. F.—Continued.
Lampsana communis L., and *Sisymbrium altissimum* L. 30915.

WHEELER, E. S. (See under G. H. Scott.)

WHIPPLE, W. B., Treasury Department: Hat worn by Jonathan Pettibone, who belonged to the Eighteenth Connecticut Militia in 1776. Deposit. 32076.

WHITE, Dr. C. A., U. S. Geological Survey: Photograph of Gameel Awad, a dragoman of Jerusalem. 31091.

WHITE, DAVID, U. S. Geological Survey: Two herbarium specimens from Pennsylvania (30887); specimen of *Asplenium ruta-muraria* from Tennessee (31076); weathered conglomerate from Sharp Mountain, east side of Westward Gap, Pottsville, Pennsylvania. (32120.)

WHITE, G. W., Washington, District of Columbia: Photograph—"Hills and Valleys, Dales and Fields." 31004.

WHITE, J. J., Rockledge, Florida: Specimens of *Cytherea varians* (31253); land and marine shells, representing 5 species, from Florida (31349.)

WHITE, Dr. J. T. (See under Young Naturalists' Society.)

WHITED, KIRK, Wenatchee, Washington: One hundred and eighty-four plants. 31112.

WHITEHEAD, JOHN, Urbana, Ohio: Pyrite nodule. 32174.

WHITEHORN, WORTH, Rochester, Nebraska: Fossil tooth of a bison. 30870.

WHITMAN, V. H., Washington, District of Columbia: Skin of a Blue Jay with a deformed bill. 31248.

WHITTEMORE, C. A. (See under Kent Scientific Institute.)

WIDMAN, OTTO, Old Orchard, Missouri: Nest and 3 eggs of Bachmann's Warbler, *Helminthophila bachmani*. (New to science and to the Museum collection.) 32139.

WILCOX, E. N., Brookings, South Dakota: Fourteen plants. 31453.

WILDER, G. D., Pekin, China: Specimen of *Sciurus* and a specimen of *Tamias*; also 53 birds' skins from northern China. Exchange. 31739.

WILKINSON, E. (See under Mansfield Memorial Museum.)

WILLETS MANUFACTURING COMPANY, Trenton, New Jersey, transmitted by the U. S. Geological Survey: Sample of

WILLETS MANUFACTURING COMPANY—Continued.
American pottery, Belleek ware, decorated under the glaze in Delft blue. 32126.

WILLIAMS COLLEGE, Williamstown, Massachusetts, transmitted by T. Nelson Dale: Twenty-one specimens of minerals from various localities. Exchange. 32220.

WILLIAMS, F. H., Greene, New York: Nest and egg of a bird (30920); transmitted from the U. S. Geological Survey, 75 specimens of Devonian fossils (31650).

WILLIAMS, F. W., New Haven, Connecticut: Assyrian cylinder seal. Lent. 31615.

WILLIAMS, H. S. (See under Interior Department, U. S. Geological Survey.)

WILLIAMS, T. A., care Department of Agriculture: Specimen of *Suæda depressa erecta* from South Dakota. 31301.

WILLIAMS, R. S., Columbia Falls, Montana, transmitted by Major Bendire: Seven birds' skins from Montana (gift) (31397); 870 botanical specimens (purchase) (31874); specimen of *Omphalodes howardi* (32069).

WILLIARD, T. E., U. S. National Museum: Geological material from Frederick, Maryland. 31152.

WILLIS, L. D., Church Creek, Maryland: Ants, representing 2 species. 31233.

WILLOUGHBY, Lieut. H. L., U. S. A., Newport, Rhode Island: Egg of American crocodile from southern Florida. 31134.

WILLS, Rev. JAMES, Antananarivo, Madagascar: One hundred and ten birds' skins, mammal skins, native basket, silk-moths and cocoons, shells, skeletons of birds and mammals, also bones and a skull, specimens of *Epiornys*, hippopotamus, birds' eggs, and reptiles from Madagascar. Purchase. 31618.

WILMER, Lieut. Col. L. WORTHINGTON, Baltimore, Maryland: Fossil and other shells from the British Islands. 31830.

WILSON, B. J., Huntington, West Virginia: Drilled ceremonial object of banded slate. Purchase. 31489.

WILSON, J. S., Wilson, New York, transmitted by Dr. H. M. Smith: Specimens of Brunnich's Murre, *Uria lomvia*, from Lake Ontario, in the flesh. 31469.

WILSON, THOMAS, U. S. National Museum: Iron image found on Rich Moun-

WILSON, THOMAS—Continued.
tain, North Carolina (31633); facsimile of the celebrated chart of Juan de la Cosa, pilot and captain in the expeditions of Columbus, the first map on which the American Continent appears, drawn in the year 1500 (31636); collection of archæological objects from ploughed fields "Noel Cemetery, Glendale Park," Nashville, Tennessee (32169, 32200). Deposit.

WINTON, G. B., San Luis Potosi, Mexico: Fishing-spear and throwing-stick (purchase) (31432); Mexican throwing-stick (31802).

WIRT, Dr. W. W., U. S. Geological Survey: Land shells and Echini from Isle of Pines, Cuba. 31772.

WOLFE, Miss EMMA A., U. S. National Museum: Specimen of *Adelonycterus fuscus*. 31902.

WOLTZ, GEORGE, U. S. National Museum: Square piano made by Joseph Hiskey, Baltimore, Maryland, during the years 1820–1845, known as the German double or Viennese action. 31877.

WOOD, N. R., U. S. National Museum: Four specimens of *Blarina* from Clyde, Wayne County, New York. 30868.

WOODS, E. L., San Francisco, California: Photograph "Marshland." 31005.

WOODWARD, Dr. HENRY. (See under London, England: British Museum.)

WOODWORTH, F. A., Alameda, California: Shells, dredged in Santa Barbara Channel, California, representing 6 species. 32091.

WOOSTER, A. F., Norfolk, Connecticut: Large Spotted Salamander (*Ambystoma punctatum*). 31942.

WORTH, S. G. (See under Fish Commission, U. S.)

WORTHEN, C. K., Warsaw, Illinois: Nine mammal skins. Purchase. 31869.

WRAY, L. (See under Larut, Perak, Straits Settlements: Perak Museum.)

WRIGHT, B. H., Penn Yan, New York: Unios from different sections of the United States. (31180) (exchange) (gift) (31219, 31336, 31360, 31386, 31478, 31505, 31563, 31597, 31712, 31863, 32078, 32146).

WRIGHT, J. T., Anson, Texas: Specimen of *Hoffmanseggia stricta* Booth. 30936.

WRIGHT, S. R., Klamath Falls, Oregon: Long-tailed duck. 31444.

WURZLOW, H., Industry, Texas: Three specimens of *Tradescantia*. 31891.

YANG YÜ, Chinese Minister, Chinese Legation, Washington, District of Columbia: A large blue porcelain vase, bronze urn, and a string of beads. 31964.

YATES, JESSE, Atlantic City, New Jersey: Short File-fish, *Monacanthus hispidus*. 30998.

YOUNG, CURTIS CLAY, Brooklyn, New York: Twenty-five heads of young Cormorants (*P. dilophus*), from Quebec. 31159.

YOUNG, J. A., Bellevue, Iowa: Photograph of a large spearhead found near Lake Pepin, on the head waters of the Mississippi River. 31635.

YOUNGBLOOD, J. E., Union, Washington: Geometrid Moth, *Triphosa dubutata*. Presented to the Smithsonian Institution and transferred to the National Museum. 31496.

YOUNG NATURALISTS' SOCIETY, Seattle, Washington, transmitted by Dr. James T. White: Plaster cast of a stone carving, the original of which was found on the San Juan group of islands, between Vancouver Island and the mainland. 31353.

ZEHNTNER, Dr. L., Proefstattion Oost-Java, Pasoeroean, Java: Four specimens of *Entedon arcuata* Zehntner, 4 specimens of *Entedon albipes* Zehntner, and 3 specimens of *Eulophus femoralis* Zehntner.

ZELL, LYDIA D., Lancaster, Pennsylvania. Three specimens of the Cleistogamous form of *Viola obliqua*. 31256.

ZIRKEL, FERDINAND. (See under Fortieth Parallel Survey.)

ZOOLOGICAL MUSEUM. (See under Kiel, Germany.)

ZOOLOGICAL MUSEUM. (See under Copenhagen, Denmark.)

ZSCHOKKE, Prof. Dr. F., Basel, Switzerland: Parasitic worms. Exchange. 31458.

ZURICH, SWITZERLAND: ZURICH BOTANICAL GARDEN, transmitted by Prof. Hans Schinz: One hundred and forty-eight herbarium specimens. Exchange. 31168.

INDEX TO ACCESSION LIST.

A.—BY LOCALITIES.

AFRICA.

AMERICA.

NORTH AMERICA.

British America.

Mexico.

United States.

Alaska—Continued.	Accession No.
Sylvester, E. O	31851
True, F. W	31951
Arizona:	
Ashmun, Rev. E. H	30888
Fewkes, Dr. J. Walter	31274, 31785, 32079
Howard, L. O	31766
Hubbard, H. G	31492, 31904, 32259
Lesser, J	31107
Meador, F	31806
Ogburn, Burt	31539, 31742, 31967
Osgood, W. H	32034
Reid, C. H	32035
Smithsonian Institution (Bureau of Ethnology)	30857, 31151, 31599
Sorin, T. R	30952
Arkansas:	
Brown, C. F	31968
California:	
Agriculture, Department of	30843, 31853
Allen, C. A	31058, 31879
Anthony, A. W	31535
Arnheim, J. S	31197, 31674, 31884, 32104
Austin, Mrs. R. M	31994
Baker, Dr. Fred	31644
Barlow, Chester	30858
Beck, R. H	31476
Braverman, M	32212
Breninger, G. F	31463
Brewer, W. H	30877
Brown, H. E	31854
Burger, W. C	31412
California Academy of Sciences	31198, 31532, 32032
Chipman, W. F	31939, 32148
Chittenden, N. H	31782
Clark, G. A	31425
Cohen, D. A	31247
Cole, Miss E. A	32042
Crosby, G. S	31598
Daggett, Hon. John	31279, 31628, 32190
Day, Dr. D. T	31305
Daniel, J. W., jr	31079
Davidson, Dr. A	31029
Dryden, Dr. R. C	31200
Ericson Brothers	31823
Emerson, W. O	30839
Fellows, G. S	30999
Fish Commission, U. S	31760
Foss, Mulberry	31838
Frost, L. L	31910
Fuchs, Charles	32258
Garner, Edward	32295
Gaylord, Horace	31245
Grinnell, Joseph	31427, 31661, 32056
Holzner, F. X	30962, 31688
Hopping, Ralph	31668
Hudson, Dr. J. W	31082, 31131
Hudson, Mrs. J. W	32063
Interior Department (U. S. Geological Survey)	31451, 31525
Jepson, W. L	31508
Judson, W. B	31284
Kessler, Frank	31927
Littlejohn, Chase	31651
Lowe, H. N	31792, 31675
McGregor, R. C	31268, 31303, 31367
California—Continued.	
Mead, G. B	32178
Moore, Hettie A	30963
Oldroyd, Mrs. T. S	31430, 31978
Paret, T. D	31662
Parish, S. B	31033, 31536, 31745, 32070
Patterson, Rose	31537
Peabody Museum	31885
Price, W. W	32011
Ransdell, J. W	32097
Renick, A. B	31139
Rose, O. G	31557
Retherford, W. O	31561, 31768, 32052
Rutter, Prof. Cloud	31142
Snyder, J. O	31776
Stearns, Dr. R. E. C	32028
Stephens, F	31919, 32053
Turner, H. W	31406
Walker, Wythe	31990
Woods, E. L	31005
Woodworth, F. A	32091
Colorado:	
Aiken, C. E	31946
Anthony, A. W	31676
Benson, H. W	31551
Bethel, E	31106
Bliss, C. F	31723
Brunton, D. W	31613
Crandall, C. S	31501
Cross, W	32096
Day, Dr. D. T	31184
Donaldson, D. V	31186
Eakle, A. S	31770
Holzinger, J. M	31396
Interior Department (U. S. Geological Survey)	30872, 31684, 31732, 31733, 31734, 31735, 31965, 32096
Lacoe, R. D	32044
Lee, W. T	31022
McGregor, R. C	31303
Osterhout, G. E	31960, 32071, 32121
Smithsonian Institution (Bureau of Ethnology)	31683
Smuggler Union Mining Company	31590
Stanton, L. H	30844
Tiffany & Co	31797
Connecticut:	
Beecher, Dr. C. E	31455, 31570, 31616
Eames, Dr. E. H	31764
Eaton, G. F	31423
Gillespie, F. B	30985
Interior Department (U. S. Geological Survey)	31959
Merrill, G. P	30972
Treat, Willard E	31591, 31700
Van Deusen, Mrs. Alys Bates	31465, 31552, 31593, 31594, 31614, 31670
Wesleyan University	32213
Williams, F. W	31615
Wooster, A. F	31942
District of Columbia:	
Adler, Dr. Cyrus	32077
Agriculture, Department of	31417, 31460, 31553, 31626, 31679, 31746, 31811, 30841, 32073
Bartsch, Paul	31708, 31790, 31906, 32152, 32252
Beckwith, Paul	32195, 32261
Benedict, J. E	31147

FLORIDA—Continued.	Accession No.
Interior Department (U. S. Geological Survey)	31527
Litchfield, Archibald	31470
McMillan, P. A	31477
Mills, R. A	30912, 31439
Pearce, C. W	31192
Pine, George	32137, 32059
Poey, F	31165
Smithsonian Institution (National Zoological Park)	32015
Stranahan, J. W	31383, 31509, 32064
Tollin, Oscar	31438
Webb, Dr. De Witt	31572, 31678, 31850
Webb, W. F	30890
Webber, H. J	31216
White, J. J	31349
Willoughby, H. L	31134
GEORGIA:	
Berckman, P. J	31135
Frix, A. M	30990
Gill, J. P	31748
Howell, E. E	30992
Kenesaw Marble Company	31015
Kunz, G. F	31306
Lycett, Edward	31784
Moore, C. B	31474
Steiner, Dr. Roland	30938, 30976, 31050, 31235, 31237, 31258, 31311, 31313, 31347, 31484, 31497, 31541, 31931, 32214
Wright, B. H	31360, 31505, 31597
IDAHO:	
Courtney, C. W	32222
Evermann, Prof. B. W	31567
Evermann, T. B	31866
Heller, A. A	31435
Meek, Prof. S. E	31610, 31619
Merrill, Dr. J. C., U. S. A	30889, 31080, 31218
Packard, R. I	31047
Spence, R. S	31108
ILLINOIS:	
Bartlett, Mrs. N G	31006
Chicago Academy of Sciences	31657, 31956, 30929
Carr, J. C	30859
Cockerton, F. T	31420, 31543, 31789
Daniels, L. E	30860
Duvall, H. C	31773, 31815, 31954
Elrod, M. J	31270
Fay, H. W	31044, 32082
Field Columbian Museum	32027
Guthrie, Ossian	31391, 31909, 32247
Hershey, O. H	31913
Hess, I. E	31680
Holmes, S. J	31402
Hood, S. B	31961
Huett, J. W	31912
Marsh, W. A	31298
Mundt, A. H	32188
Newsam, Frank	30939
Phillips, Dr. W. A	31837
Robertson, Charles	30971
Root and Field	32150
Sheahan, Thomas	31727
Smithsonian Institution (Bureau of Ethnology)	31883

ILLINOIS—Continued.	Accession No.
Thompson, H. D	32264
Worthen, C. K	31869
INDIAN TERRITORY:	
Interior Department (U. S. Geological Survey)	31852
Smithsonian Institution (Bureau of Ethnology)	32272
INDIANA:	
Blatchley, W. S	31641
Daniels, L. E	31592
Hessler, Robert	31452
Kirsch, P. H	30894, 31021
Smithsonian Institution	31263
Smithsonian Institution (Bureau of Ethnology)	30961
Sprinz, B	31202, 31606
Taylor, J. G	30960
Test, Dr. F. C	32223
Twomey, George	31263
IOWA:	
American Archæological and Asiatic Association	31632
Anderson, R. M	30869
Goddard, Herbert	32260
Hall, D. F	32170
Iowa, State University of	32029
Le Grand Quarry Company	31826
Osborn, Prof. H	31519
Pammel, L. H	31671, 32000
Smithsonian Institution (Bureau of Ethnology)	32138
Strong, Miss Louise L	32162
Van Hyning, T	32037
Young, J. A	31635
KANSAS:	
Acker, Dr. E. S	31660
Agriculture, Department of	31389, 31738
Baker University	31515
Chase, Dr. A. G	31549
Clarke, Prof. F. W	31188
Cooley, Bartlett	31810
Crevecoeur, F. F	31418
Gould, C. N	32262
Knaus, Warren	30900, 31190
Meeker, Grace	30881
Osborn, Dr. E. H	32271
Peek, Amos	30919
Perkins, L. M	31203
Pringle, H. N	31027
Smithsonian Institution	31188
Smithsonian Institution (National Zoological Park)	32020
Ward, Prof. L. F	31358
KENTUCKY:	
Burns, W. R	32031
Call, Prof. R. Ellsworth	31943
Dickhaut, H. E	31431
McGuire, Hon. J. D	31958
Taylor, J. G	30960
Terrell, J. A	31122, 31317
LOUISIANA:	
Beyer, Dr. G. E	31608, 32101, 32282
Brodnax, Dr. B. H	31149
Frierson, L. S	31127, 31486, 31833
McAdoo, W. G., jr	31575

MONTANA—Continued. Accession No.

- Interior Department (U. S. Geological Survey) 31664, 31665, 31705, 31750, 31762, 32241
- Knauth, E 31070
- Mumbrue, D. P 32047
- Rydberg, P. A 31932, 32173
- Smithsonian Institution (National Zoological Park) 31023, 31577
- Traphagen, F. W 31183
- Williams, R. S 31397, 31874, 32069

NEBRASKA:

- Ashmun, Rev. E. H 30888
- Bates, J. M 31419
- Betteswortli, G. W 31988, 32065
- Bourke, Mrs. J. G 31963
- Latler, H. A 30907
- Nebraska, University of 31498
- Sabine, G. W 31400
- Scott, George 31779
- Skow, Lawrence 31401
- Smout, Mrs. T. J 31848
- Trostler, Isador S 31835
- Whitehorn, Worth 30870

NEVADA:

- Kayser, W 31668
- Walcott, Hon. C. D 32045

NEW HAMPSHIRE:

- Eaton, A. A 31930
- Hitchcock, Prof. C. H 31520
- Thayer, A. H 30854

NEW JERSEY:

- Beckers, Alex 32191
- Beckett, W. H 31992
- Cassady, J. M 31176
- Ceramic Art Company 31637
- Fewkes, Dr. J. W 31785
- Havens, J. G. W 31243
- Princeton University, Trustees of 32030
- Smith, Prof. J. B 30908, 32199
- Smithsonian Institution 32030
- Washington, H. S 30911
- Willetts Manufacturing Company 32126
- Yates, Jesse 30998

NEW MEXICO:

- Agriculture, Department of 31144, 31244, 32181
- Ashmun, Rev. E. H 30888, 31279
- Biederman, C. R 32149
- Cockerell, Prof. T. D. A 30948, 31061, 31621, 32025, 32072
- De Mier, J. R 32109
- Gold, J 31446
- Interior Department (U. S. Geological Survey) 31684
- Key, Clarence 31977
- Metcalfe, J. K 31861
- Mindeleff, Cosmos 30945
- Smith, H. I 31441
- Smithsonian Institution (Bureau of Ethnology) 31983, 32102, 32288
- Tinsley, J. D 31392

NEW YORK:

- Agriculture, Department of 31370, 32192
- Bierstadt, E 31090
- Blunck, A. E 31584
- Britton, Dr. N. L 31709
- Brown, Mrs. J. Crosby 31791, 32008

NEW YORK—Continued. Accession No.

- Brooks, A. H 32012
- Burtch, Verdi 31264, 31445, 31468, 31574, 31669
- Carpenter, Capt. W. L., U. S. A 32244
- Cashman, N 32194
- Clarke, Prof. J. M 31757
- Dale, T. Nelson 31900
- Davis, J. W 31588
- Dayton, C. N 31098
- Dean, S. B 31855
- Dyar, Dr. H. G 31166
- English, G. L., & Co 31898
- Enos, Mrs. D. C 32061
- Franklin, T. W 30582
- Gill, Dr. T. N 31057
- Gilman, Collamore & Co 32050
- Goode, Dr. G. Brown 30966
- Hanselman, J. J 30926
- Hart, W. W. & Co 31759
- Haswell, C. H 31871
- Hawley, F. W 31821
- Higgins and Seiter 31576
- Holcomb, E. G 31585
- Interior Department (U. S. Geological Survey) 31065
- Judson, Mrs. Isabelle Field 32289, 32290
- Kan Ko Ba 31935
- Kelekian, D. G 31915
- Kelly, J. E 31310
- Kessler, Frank 31928
- Kny-Scheerer & Co 31969
- Kunz, G. F 30901, 31365
- Lowe, Dr. J. N 32130
- McGee, S. B 31526
- McKesson & Robbins 31825
- Mearns, Dr. E. A., U. S. A 31110, 31250, 31342
- Meder, Ferd 31805
- Merrill, G. P 31753
- Moore, Mrs 31638
- Niven and Hopping 31012
- Pinkerton, Mrs. S. E 32083
- Ralph, Dr. W. L 32007
- Regua, Mrs. E. M 32115
- Rydberg, P. A 31832, 32110
- Sanshodo 31908, 31937
- Savage, M. F 31372
- Small, Dr. J. K 31421, 32036
- Smithsonian Institution 32007
- Smithsonian Institution (National Zoological Park) 31414
- Snyder, Dr. F. D 31495
- Starin, Col. J. H 31573
- Stevenson, Prof. J. J 32276
- Stevens, S. G 31195
- Stranahan, J. W 32254
- Tassin, Wirt 31300
- Tellery, S. J. & Co 30965
- Tiffany, C. L 30951
- Tiffany & Co 31143, 31899, 31936
- Underwood, Prof. L. M 32184
- Van Gaasbeak & Arkell 31914, 31952
- Ward, H. A 30953
- Ward's Natural Science Establishment 31698, 31704, 31720, 31741, 31744, 31756, 31758, 31780, 31782, 31793, 31896, 31981, 31982, 32005, 32006, 32054

Rhode Island—Continued.	Accession No.
Dickins, Commander F. W., U. S. N.	31696
Drowne, F. P	30895
Lewis, G. A	30947, 32041
Taylor, Miss Evelyn	31847
Thompson, M. T	31814
South Carolina:	
Hutchinson, I. W	31111
Johnson, J. N	30982
Stilton, J. J	32132
Wayne, A. T	30852, 30906, 31273, 31296, 31344, 31920, 31976, 32202, 32203, 32229, 32243
South Dakoka:	
Boyle, Dr. C. B	31017
Coues, Dr. Elliott	31157
Daniel, Dr. Z. T	30987
Ellis, E. A	31715, 32108
Forwood, Dr. W. H., U. S. A	30902
Kane, W. G	31116
Van de Erve, H	32233
Wilcox, E. N	31453
Williams, T. A	31301
Tennessee:	
Benedict, J. E	32158
Kearney, T. H., jr	31602
Palmer, William	32105
Pilsbry, H. A	31018
Schuchert, Charles	32166
Watson, J. M	30950
Wilson, Thomas	32169, 32200
Texas:	
Agriculture, Department of	32127, 32135
Attwater, H. P	31077, 31114, 31890
Benners, G. B	31283
Boscoe, J. F	31346
Brensing, H	32129
Drushell, J. A	31929
Fish Commission, U. S	31009, 31167, 32043
Gregory, James	30927
Hildebrandt, A. M	32095, 32185
Hill, R. T	31309, 32156
Hopkins, Miss Sue	31204
Howard, N. C	31038
Lewis, E. C	31104
Locke, Otto	31940
Marsh, W. A	31410
Mitchell, Hon. J. D	31030, 31171, 31524, 31787, 31804, 32085, 32124, 32226
Nesmith, H. M	32211
Neville, E. A	31579
Price, R. H	32210
Reverchon, J	30867
Rose, J. N	32255
Sayers, Mrs. J. D	31778
Schaupp, F. G	31996
Shufeldt, Dr. R. W	32164
Simpson, T. L	32125
Skrehot, R. F	31547
Smithsonian Institution (National Zoological Park)	30848
Spencer, A. L	32208
Thorpe, H. H	30864, 31257
Von Steeruwitz, W. H	31510
Wright, J. F	30936
Wurzlow, H	31891

Utah:	Accession No.
Day, Dr. D. T	31405
Eastwood, Miss Alice	31037
Gilbert, G. K	31571
Heiks, V. C	31544
Hillebrand, Dr. W. F	31066
Howell, E. E	30940
Interior Department (U. S. Geological Survey)	31291
Jones, W. E	31615
Merriam, Dr. C. Hart	32094
Stearns, Elmer	32236
Vermont:	
Dale, T. Nelson	31900
Hitchcock, Prof. C. H	31520
Howe, M. A	31102
Interior Department (U. S. Geological Survey)	31731
Virginia:	
Ayers, George	31461
Bartsch, Paul	32269, 32286
Boyd, C. R	31586
Brewster, William	31603
Broders, A. C	31045
Brown, E. J	31559
Campbell, M. R	32143
Daniel, J. W., jr	31079
Engle, H. M	31294
Figgins, J. D	31831
Fisher, Capt. Walter	31169
Frierson, L. S	31640
Goad, G. W	31055
Hitchins, Capt. G. D	32257
Howell, E. E	31672
Hunter, William	30903
Interior Department (U. S. Geological Survey)	30980
Lune, William	31137
McCullock, J	30838
Mearns, Dr. E. A., U. S. A	30892, 30923, 30925, 31480, 32216
Mearns, L. di Z	31538, 31578
Merrill, G. P	31275
Morgan, Dr. E. L	32246
Morrison, J. H	32013
National Society, Daughters of the American Revolution	31488
Newhall, W. H	31953
Palmer, William	31020, 32182, 32256, 31356
Paul, Col. A. C., U. S. A	31361
Prentiss, D. W., jr	32263, 32274
Proudfit, A. V	31774
Riley, J. H	31178, 31246, 32026
Robinette, F	32177
Robinette, G. W	31208
Robinette, J. D	31013, 31051
Robinson, Lieut. Wirt, U. S. A	31153
Robinson, W. R	31059
Rorebeck, C. G	31295
Smithsonian Institution (National Zoological Park)	32128
Sword, J. F	30974
Tassin, Wirt	31292
Warden, Jacob	30958
Wright, B. H	31563

West Indies.

CENTRAL AMERICA.

SOUTH AMERICA.

ASIA.

	Accession No.
Stanford, A. W	32235
Stejneger, Dr. Leonhard	31577
Tokyo, Japan: Science College of the Imperial University	31817, 32118
Tribolet, Mrs. M. A	32074
Varsovie, Russia: Branicki Museum	32231
Ward's Natural Science Establishment, Rochester, N. Y	31895
Wilder, G. D	31739
Yang Yü, Chinese minister	31964

Asia Minor.

White, Dr. C. A	31091

EUROPE.

(INCLUDING GREAT BRITAIN.)

	Accession No.
Adler, Dr. Cyrus	30910
Barcelona, Spain: Royal Academy of Science and Arts	31226
Berlin, Germany: Botanical Museum	31751
Berlin, Germany: Royal Zoological Museum	31339, 31607
Boettcher, F. L. J	31105
Boucard, A	31634
Brick, Dr. C	31717
Brown, C. S	30891
Bryant, H. G	31832, 32010
Chernelháza, Stefen Chernel von	31164
Comes, Prof. O	30849
Cook, Mrs. O. F	31092
Copineau, C	30957
Cornell University, Ithaca, N. Y	31975
English, G. L., & Co	31404
Geneva, Switzerland: Musée d'Histoire Naturelle	32268
Given, J. F	32187
Glaisher, James	31950
Hamburg, Germany: Hamburg Museum	31338
Hemsley, W. B	31800
Herman, W. W	31409, 31487
Hind, Dr. Wheelton	30896
Hintze, A	32090
Holm, T. W	31054
Hough, Walter	31440
Howell, E. E	30934, 32242
Karnten, Austria: Tiroler Botaniker, Die Freie Vereinigung	30885
Kiel, Germany: Zoological Institute	31693
Kindle, E. M	31529
Koehler, Dr. R	32234
Kowalewski, Dr. M	31456
Langdale, J. W	31794
Lassimonne, S. E	31428
Leche, Prof. Wilhelm	31136
Lemke, Madame E	31795
Lendenfeld, von, Prof. R	32175
London, England: British Museum	31482, 31583
Lyons, France: Museum of Natural History	31540
Manchester, England: Manchester Museum	32277
Meek, Prof. S. E	32197
Moss, William	32180, 32275
Nutt, David	31132
Oxford, England: Oxford University Museum	31121
Paris, France: Museum of Natural History	32112
Pearson, W. H	31558
Prentiss, D. W., jr	31206, 31209
Railliet, Prof. A	31457
Salford, Lancashire, England: Royal Museum	30865
Schumann, Dr. K	31862
Seaton-Karr, H. W	31522
Smithsonian Institution	31950
Tassin, Wirt	31293, 31889
Thayer, A. H	32176
Thompson, D'Arcy	31639
Tring, England: Tring Museum	31302
Tschusi, von, Victor Ritter zu Schmidhoffen	31073
Turin, Italy: Royal Zoological Museum	31464, 32224
Vienna, Austria: Royal Natural History Society Hofmuseum	31355
Warming, Dr. E	31930
Wesley, W., & Son	32089
Zschokke, Prof. Dr. F	31458
Zurich, Switzerland: Zurich Botanical Garden	31168

OCEANICA.

AUSTRALASIA.

Australia.

Agriculture, Department of	31926
Baker, R. T	31101, 31163, 31212
Bogan, R	31434
Boucard, A	31555
Brick, Dr. C	31117
Clark, James	30886
Dall, Dr. W. H	32179
Grant, F. H	31542
Smithsonian Institution (National Zoological Park)	31398
Sutor, Henry	31245, 31812
Sydney, New South Wales: Australian Museum	31081
Müller, von, Baron Ferd	31040, 31060, 31088, 31266
Ward's Natural Science Establishment, Rochester, N. Y	32155

Malaysia.

Polynesia.

Islands in the Southern Pacific Ocean.

B.—BY DEPARTMENTS IN THE NATIONAL MUSEUM.

DEPARTMENT I.

Mammals.

DEPARTMENT II.

Birds.

Accession No.

Cox, Miss Hazel van Zandt 31154, 31182
Danhaker, John 31971
Dennison, G. W 32144
Figgins, J. D 31831, 31840
Filer, W. B 32298
Fisher, Capt. Walter 31169
Fleming, J. H 31068, 31097
Flood, O. D 31072
Francis, Joseph 32232
Gill, Dr. T. N 32204
Grahamstown, South Africa: Albany Museum 31249, 32140
Grinnell, J 31427, 31661, 32056
Hamilton, M 31272
Hasbrouck, Dr. E. M 31234, 31556
Hess, I. E 31680
Hewitt, A 30851
Heyde, Rev. H. T 31516
Hinton, Prof. W. B 31348
Hintze, A 32090
Ingersoll, J. C 31019
Judson, W. B 31284
Kent Scientific Institute, Grand Rapids, Mich 31056
Knowlton, F. H 32253
Lano, A 31494, 31689
Leiter, Joseph 31514
Littlejohn, Chase 31651
Lucas, F. A 31220
McIlhenny, E. A 31120
McGregor, R. C 31268, 31367
McMillan, P. A 31477
Masterman, E. E 31448
Mead, G. B 32178
Mearns, Dr. E. A., U. S. A 31110, 31250
Meeks, Prof. S. E 31610
Merrill, Dr. J. C., U. S. A 30889, 31218
Merritt, W. A 31925
Mitchell, G. E 31769
Morrell, C. H 31718
Newhall, W. H 31953
Osgood, W. H 32034
Palmer, William 31752, 32105
Pearce, C. W 31192
Prentiss, D. W., jr 32263, 32274
Price, W. W 32011
Ralph, Dr. W. L 32007
Richmond, C. W 31769
Ridgway, Albert 31172, 31329, 31589
Riley, J. H 32026
Robinette, F 32177
Robinson, Lieut. Wirt, U. S. A 31153
Rose, O. G 31557
Sabine, G. W 31400
Schmid, E. S 31146, 31269, 31271, 32080
Scott, Prof. W. B 32297
Sheriff, D. T 31375
Skow, Lawrence 31401
Smithsonian Institution 32007
Smithsonian Institution (National Zoological Park) 31023
31145, 31299, 31677, 31882, 31921
Snyder, Dr. F. D 31495
Snyder, J. O 31776
Starin, Col. J. H 31573
Stejneger, Dr. Leonhard 31801

Accession No.

Sullivan, G. N 31690
Sydney, New South Wales: Australian Museum 31081
Terrell, J. A 31122, 31317
Thayer, A. H 32176
Thorne, E. J 30914
Tokio, Japan: Science College, Imperial University 31817
Treat, W. E 31700
Tring, England: Tring Museum 31302
Trostler, I. S 31835
Tschusi, von, Victor Ritter zu Schmidhoffen 31073
Varsovie, Russia: Branicki Museum 32231
Victoria, British Columbia: Provincial Museum 31158, 31415
Ward's Natural Science Establishment, Rochester, N. Y 31704, 31741
Wayne, A. T 30852, 30906, 31273, 31296, 31344
31920, 31970, 32202, 32203, 32229, 32243
Webb, W. F 30890
Widmann, Otto 32139
Wilder, G. D 31739
Williams, R. S 31397
Wills, Rev. James 31618
Wilson, J. S 31489

DEPARTMENT III.

Birds' Eggs.

Abbott, Dr. W. L 31341
Allen, C. A 31058
Anthony, A. W 31260, 31282
Attwater, H. P 31077
Barlow, Chester 30858
Benners, G. B 31283
Boardman, G. A 31261
Brown, E. J 31201
Brownlow, Hon. W. P 31605
Bryant, E. S 31069
Cohen, D. A 31247
Daniel, J. W., jr 31079
Emerson, W. O 30839
Gaylord, Horace 31245
Hewitt, A 31049
Johannes, I. W 31285
Judson, W. B 31284
Merrill, Dr. J. C., U. S. A 31080
Neville, E. A 31579
Riley, J. H 31178, 31246
Robinson, W. R 31059
Trostler, I. S 31835
Williams, F. H 30920
Wills, Rev. James 31618

DEPARTMENT IV.

Reptiles and Batrachians.

Abbott, Dr. W. L 31341, 31941
Allen, C. A 31058
Anthony, A. W 31199
Bartsch, Paul 32152, 32252
Benedict, J. E 32158
Brimley, H. H., & C. S 31546, 31728, 31924
Cook, Prof. O. F 31014
Cory, C. B 32004
Daniel, Dr. Z. T 30932

DEPARTMENT V.

Fishes.

DEPARTMENT VI.

Mollusks.

	Accession No.
Prentiss, D. W., jr	32274
Randolph, P. B	31786
Rathray, Rev. B. F	31518
Robinette, G. W	31208
Robinette, J. D	31013, 31051
Rush, R. C	32267, 32299
Rush, Dr. W. H., U. S. N	32280
Schuchert, Charles	31230, 31241
Shriver, Howard	32106
Shufeldt, Dr. R. W	32164
Stearns, Dr. R. E. C	32028
Stejneger, Dr. Leonhard	31801
Sterki, Dr. V	31323
Sutor, Henry	31254, 31381, 31812
Swan, J. G	31442
Sword, J. F	30974
Sydney, New South Wales: Australian Museum	31081
Ten Eyck, Miss D	31321
Van Hyning, T	32037
Vaughan, T. Wayland	31966
Walker, Dr. Bryant	31024, 31094, 32087
Ward's Natural Science Establishment, Rochester, N. Y	32054
Webb, De Witt	31572, 31678
Webb, W. F	31459
Wetherby, A. G	31028
White, J. J	31349
Wills, Rev. James	31618
Wilmer, Worthington, Lieut. Col. L	31830
Wirt, Dr. W. W	31772
Woodworth, F. A	32091
Wright, B. H	31180, 31219, 31360, 31386, 31478, 31505, 31563, 31597, 31712, 31863, 32078, 32146

DEPARTMENT VII.

Insects.

	Accession No.
Abbott, Dr. W. L	31341, 31391
Agriculture, Department of	31144, 31244, 31389, 31738, 31926, 32196
Baker University, Baldwin, Kans	31515
Barrett-Hamilton, G. E. H	31335
Bartsch, Paul	31906
Berlin, Germany: Royal Zoological Museum	31339
Brensing, H	32129
Brimley, C. S	30964, 31000
Call, R. Ellsworth	31943
Chastrand, A. D	31471
Cockerell, Prof. T. D. A	30948, 31061, 32035, 32072
Cole, Miss E. A	32942
Cook, Prof. O. F	30981
Coquillett, D. W	32098
Dall, W. H	31881
Davidson, Dr. A	31029
Drowne, F. P	30895
Dugès, Dr. A	31673, 31907, 31991, 32131
Dyar, Dr. H. G	31166
Enos, Mrs. D. C	32061
Evermann, Prof. B. W	31867
Evermann, T. B	31866
Foetterle, J. G	30921
Frix, A. M	30990
Fuchs, Charles	32258
Garner, Edward	32295
Geneva, Switzerland: Museum of Natural History	32268
Goode, Master P. B	30946
Hamburg, Germany: Hamburg Museum	31338
Harrington, W. H	31351
Heidemann, O	32287
Henshaw, H. W	31491
Hilbourn Printing Co., Hart, Mich	30922
Hooper, J. J	30835
Hopping, R	31688
Hubbard, H. G	31016, 31025, 31492, 31493, 31904, 32259
Kayser, William	31668
Keen, Rev. J. H	30856, 31222
Knauss, Warren	30900, 31190
Kruger, P. W	32046
Lehan, Paul	32075
Lincoln, H. D	32147
Lowe, Dr. J. N	32130
Marlatt, Dr. C. L	31788
Meador, F	31806
Mearns, Dr. E. A., U. S. A	31110
Mills, R. A	30912
Mitchell, Hon. J. D	31030, 32124, 32085, 32226
Namiye, M	31490
Nordstrom, O. F	31807
Osborn, Dr. E. H	32271
Osborn, Prof. H	31519
Palm, Charles	31327
Patterson, Rose	31537
Poey, F	31165
Prentiss, D. W., jr	32274
Pulliam, R. R	30878
Ranbo, M. E	30834, 32183
Ransdall, J. W	32097
Rector, J	32249
Retherford, W. O	31768, 32052
Robertson, Charles	30971
Rothrock, Dr. Thomas	31923
Root & Field	32150
Rubin, C. A	30947
Ruff, J. A	30991
Saunders, W. G	31808
Schwarz, E. A	31493
Silton, J. J	32132
Simpson, T. L	32125
Smith, Mrs. A. M	31918
Smith, Prof. J. B	30908, 32199
Smith, L. H	30905
Smithsonian Institution	31496
Smithsonian Institution (Bureau of Ethnology)	31151
Snyder, Dr. D. W	31155
Snyder, J. O	31776
Spainhour, J. M	32060
Spencer, A. L	32208
Stanton, T. W	31475
Stearns, Dr. R. E. C	32028
Stejneger, Dr. Leonhard	31801
Strong, Miss L. Q	32162
Thompson, M. T	31814
Thorpe, Dr. H. H	31257
Ulke, Henry	31259
Walker, Dr. Bryant	31024
Walker, Wythe	31990

DEPARTMENT VIII.

Marine Invertebrates.

Section of Helminthology.

DEPARTMENT IX.

Comparative Anatomy.

DEPARTMENT X.

Paleontology.

Vertebrate fossils.

Invertebrate fossils.

	Accession No.
Castcel, J. N	31512
Chase, Dr. A. G	31549
Clarke, Prof. J. M	31757
Cockerton, F. T	31420, 31543, 31789
Craig, R. L	31160
Dickhaut, H. E	31431
Deisher, H. K	31564
Daniels, L. E	30860
Duvall, H. C	31815
Erve, H. Van de	32233
Gordon, R. H	31649, 31730, 31816
Gould, C. N	32262
Grant, Col. C. C	30993, 31569
Grant, F. H	31542
Greger, D. K	31550, 31729
Gresley, W. S	31473
Gurley, R. R	30861
Herger, Rev. H	31955
Hershey, O. H	31913
Hind, Dr. Wheelton	30896
Hough, Walter	31382
Howell, E. E	31706, 32165
Interior Department (U. S. Geological Survey)	30980
	31395, 31762, 31852, 31959, 31976, 32168
Kindle, E. M	31529
Knight, Prof. W. C	31767
Knowlton, F. H	31161
Lacoe, R. D	32044
Le Grand Quarry Company, Marshalltown, Iowa	31826
Lehman, W. V	31379, 31499
London, England: British Museum	31583
Manchester, England: Manchester Museum	32277
Matthew, Dr. G. F	31424
Morrison, Prof. J. H	32013
Moore, Mrs	31638
Mumbrue, D. P	32047
Nebraska, University of	31498
Oxford, England: Oxford University Museum	31121
Poey, F	31165
Pringle, H. N	31027
Sardeson, Dr. F. W	31726
Sayers, Mrs. J. D	31778
Schuchert, Charles	31376
	31377, 31378, 31449, 32166
Scott, George	31779
Sheahan, Thomas	31727
Smithsonian Institution (Bureau of Ethnology)	31151
Spence, R. S	31108
Stanton, T. W	31162
Stout, Wilbur	31373, 31443
Van Kirk, J	31297
Ward's Natural Science Establishment, Rochester, N. Y	31698
	31720, 31756, 31758, 31793
Whitehorn, Worth	30870
Williams, F. H	31650
Wills, Rev. James	31618

Fossil plants.

	Accession No.
Lorenz, John	32099
Newsam, Frank	30939
Stearns, Dr. R. E. C	32028
Stejneger, Dr. Leonhard	31801

DEPARTMENT XI.

BOTANY.

	Accession No.
Agriculture, Department of	30836, 30837, 30841
	30842, 30843, 30988, 31229, 31370, 31417, 31460
	31485, 31531, 31533, 31553, 31626, 31679, 31681
	31695, 31746, 31811, 31853, 32127, 32192, 32135
Andrews, J. O	31099
Anthony, A. W	31535
Applegate, E. I	31331
	31345, 31654, 31972, 31997, 31999
Attwater, H. P	31890
Austin, Mrs. R. M	31994
Baker, C. F	31723
Baker, R. T	31101, 31163, 31212
Bartsch, Paul	31708, 31790
Batalin, Alex	31126
Bates, J. M	31419
Berckman, P. J	31135
Berlin, Germany: Botanical Museum	31707, 31751
Bethel, E	31106
Biltmore Herbarium, North Carolina	31818, 32238
Blankinship, J. W	31873
Brewer, W. H	30877
Brick, Dr. C	31117
Briggs, A. A	30975
	31039, 31100, 31141, 31332
Britton, Dr. N. L	31709
Brodnax, B. H	31149
Brown, H. E	31854
Brown, R. L	30891
Bush, B. F	31765, 31798, 31829, 31836
Buzzard, S. S	31554
Calcutta, India: Botanic Garden	31213, 31842
California Academy of Sciences	31532
Cassady, J. M	31176
Canby, W. M	31725, 31743
Chipman, W. F	31939, 32148
Cockerell, Prof. T. D. A	31042
Collins, F. S	31343, 31703
Collins, J. F	31893
Comes, Prof. O	30849
Cook, Prof. O. F	30981, 31086
Cook, Mrs. O. F	31052, 31092, 31118, 31252
Copineau, C	30957
Coville, Frederick V	31308, 31993
Crandall, C. S	31501
Crevecoeur, F. F	31418
Crosby, G. S	31598
Cummings, Miss C. E	31393
Curtiss, A. H	30977, 31067, 31214, 31447, 31722
Dail, J	32001
Deane, Walter	31799
De Mier, J. R	32109
Dewey, L. H	31150, 31251, 32038, 32284
Drushel, J. A	31929
Dugès, Prof. A	31368
Eames, Dr. E. H	31764
Earle, Prof. F. S	32240
Eastwood, Miss Alice	31037
Eaton, A. A	31930
Eaton, G. F	31423
Ellis, E. A	31715, 32108

DEPARTMENT XIV.

PREHISTORIC ANTHROPOLOGY.

DEPARTMENT XV.

ETHNOLOGY.

Accession No.

Howell, Dr. E. E. 31109
Hudson, Dr. J. W 31082, 31131
Hudson, Mrs. J. W 32063
Hunter, Charles 31466
Johnson, C. E 32119
Kunz, G. F 31365
Lemke, Mrs. Elizabeth 31795
Mason, Prof. O. T 31630
Menchini, L 31189
Merrill, Dr. G. P 30944, 31824
Merrill, L. H 32189
Mindeleff, Cosmos 30945
Nelson, E. W 31796
Palmer, Edward 31859
Palmer, William 31130
Paschal, J. W 31949
Porter, W. D 31231
Prentiss, D. W., jr 32270
Rockhill, W. W 31129
Salford, Lancashire, England: Salford Royal Museum 30865
Savage, M. F 30845, 31372
Schneider, Louis 31138
Seidmore, Miss E. R 31224
Sherman, C. A 31686
Smithsonian Institution (Bureau of Ethnology) 31151
31737, 31983, 32138, 32250, 32272, 32288
Snyder, Rev. D. W 31155
Stranahan, J. W 31383, 31509, 32064
Tribolet, Mrs. M. A 32074
True, Dr. Frederick W 31951
Van Gaasbeek & Arkell 31952
White, Dr. C. A 31091
Wills, Rev. James 31618
Winton, G. B 31432, 31802

DEPARTMENT XVI.

ORIENTAL ANTIQUITIES.

Kelekian, D. G 31915
Kunz, G. F 31365
Polock, M 30995
Nutt, David 31132
Sanshodo, The 31908
Shanghai, China: St. John's College 31156
Van Gaasbeek & Arkell 31914
Wesley, William, & Son 32089
Williams, F. W 31615

DEPARTMENT XVII.

ARTS AND INDUSTRIES.

Abbott, Dr. W. L 31341
Adler, Dr. Cyrus 30910, 32077
Agriculture, Department of 32073
American Electrical Works, Providence, R. I 31548
Amherst College Observatory, Amherst, Mass 31985
Anthony, A. W 32114
Appleton, J. M 31007
Benner, W. H 32161
Bartlett, Mrs. N. Gray 31006
Beckers, Alex 32191
Beckwith, Paul 32195, 32261
Bierstadt, E 31090

Accession No.

Biscoe, H. L 30928
Bolton, H. C 31631
Boucard, A 31634
Brown, Mrs. J. Crosby 31612, 31791, 32008
Burns, W. R 32031
Calkins, Lieut. C. G., U. S. N 31289
Cashman, N 32194
Ceramic Art Co., Trenton, N. J 31637
Chapman, S. H. & H 31876
Cowdry, C. H., Machine Works, Fitchburg, Mass 31687
Day, F. H 31288
Dayton, C. N 31098
Doubleday, Mrs. Abner 31948
Du Boise, H. G 31844
Eastwood, Fred 32113
Evans, A. B 31089
Fay, H. W 32082
Fewkes, Dr. J. Walter 31785
Gillespie, F. B 30909, 30985
Gilman, Collamore & Co 32050
Given, J. F 32187
Glaisher, James 31950
Goode, Dr. G. Brown 30966
Hall, D. F 32170
Haswell, C. H 31871
Hawley, F. W 31821
Haymond, Mrs. Dorcas 31352
Heliotype Printing Co., Boston, Mass 31809
Henry, Miss M. A 32291, 32292, 32293, 32294
Higgins and Seiter 31576
Hodge, Dr. E. R 32116
Interior, Department of 32206
Judson, Mrs. Isabelle Field 32289, 32290
Kan Ko Ba 31935
Kelly, J. E 31310
Kunz, G. F 30901, 31365
Lowdermilk, W. H., & Co 30943
Lycett, Edward 31784
McAdoo, W. G., jr 31575
McKesson & Robbins 31825
Meder, Ferd 31805
National Society Daughters of the American Revolution 31371, 31488, 31611, 32014, 32039
Olmstead, Mrs. S. H 31702
Paul, Col. A. C 31361
Pinkerton, Mrs. S. E 32083
Princeton University, Trustees of 32050
Ramsey, Thomas 31315
Regua, Mrs. E. M 32115
Ridgway, Dr. T. E 31521
Sanshodo, The 31937
Sprinz, Bernard 31202, 31606
Smithsonian Institution 31950, 32030, 32093
Smithsonian Institution (Bureau of Ethnology) 30961
Smout, Mrs. T. J 31848
Telegraphic Historical Society of North America 31175, 31545
Tellery, S. J., & Co 30965
Tiffany, C. L 30951
Tiffany & Co 31143, 31936
Treasury Department (Bureau of Engraving and Printing) 31357
Van Deusen, Mrs. Alys Bates 31465
31552, 31593, 31594, 31614, 31670

APPENDIX III.

List of the Accessions to the Museum Library by Gift and Exchange during the Fiscal Year ending June 30, 1897.[1]

I.—INSTITUTIONS.

AFRICA.

Cape Colony.

Cape Town.

South African Philosophical Society.

Transactions, VII, pt. 2, 1896. [III, pt. 2; V, pt. 2; VI, pts. 1–2; VII, pt. 1.]

Egypt.

Cairo.

Institut Égyptien.

Bulletin, (3) V, pts. 8–9, 1894; VI, 1895. [(3) V, pts. 1–7.]

Madagascar.

Antananarivo.

Antananarivo Annual and Madagascar Magazine, I, 1875–1878; II, 1881–1884.

AMERICA.

NORTH AMERICA.

British America.

Chicoutimi.

Le Naturaliste Canadien, XXIII, pts. 6–12, 1896; XXIV, pts. 1–5, 1897. [XXI–XXII; XXIII pts. 1–5]

Halifax.

Nova Scotian Institute of Natural Science.

Proceedings and transactions, (2) II, pt. 2, 1895–1896. [I, pt. 4; III; IV, pts. 1–3; V, pts. 3–4; VI–VII; (2) I; II, pt. 1.]

Montreal.

Natural History Society.

Canadian Record of Science, VII, pts. 1–4, 1896–1897. [Complete.]

Ottawa.

Department of Agriculture, Central Experimental Farm.

Bulletin 25, 1896. [21–23.]

Geological Survey of Canada.

Annual report, n. s., VII, 1894. [1843–1871, 1874–1893.]

Contributions from the herbarium of the Geological Survey of Canada. James M. Marcoun. Pt. 8, 1895. p. 1–11; pt. 9, 1896. p. 39–50 < Canadian Record of Science.

List of plants known to occur on the coast and in the interior of the Labrador peninsula. James M. Marcoun. Ottawa, 1896. 8vo, p. 353–366. < Ann. Rep. Geol. Surv. Canada, 1896.

Quebec.

Université Laval.

Annuaire, 1896–1897. [1892–1895.]

St. John.

Natural History Society of New Brunswick.

Bulletins, 6–10, 14. [Complete.]

St. Laurent.

St. Laurent College.

Bulletin, no. 12, 1897. [10–11.]

Toronto.

Canadian Institute.

Proceedings, n. s., I, pt. 1, 1897.

Transactions, V, pt. 1, 1896. [Complete.]

Winnipeg.

Department of Agriculture and Immigration.

Bulletins, 49–50, 1894–1896. [44–48.]

Report, 1895.

[1] The numbers of volumes and parts given in brackets at the end of each entry indicate what the library already possesses of the various series.

Winnipeg—Continued.
HISTORICAL AND SCIENTIFIC SOCIETY.
Annual report, 1894–1895. [1886–1887, 1890–1893.]
Transactions, no. 48, 1896.

Mexico.

Aguascalientes.
El Instructor, XIII, pts. 3–12, 1896, XIV pts. 1–2, 1897. [XII, pts. 3–4.]

Mexico.
INSTITUTO GEOLOGICO DE MÉXICO.
Boletín, 3–6, 1896–1897. [2.]
INSTITUTO MÉDICO NACIONAL.
Anales, II, pts. 1–5, 1896; III, pt. 1, 1897. [I, pt. 8.]
SOCIEDAD CIENTIFICA "ANTONIO ALZATE."
Memorias y revista, IX, pts. 7–10, 1895–1896. X, pts. 1–4, 1896–1897. [III–VII, IX, pts. 1–6.]

United States.

Alabama.

Montgomery.
POLYTECHNIC INSTITUTE, STATE AGRICULTURAL AND MECHANICAL COLLEGE.
Catalogue, 1894–1895. [1888–1893.]

California.

Berkeley.
UNIVERSITY OF CALIFORNIA.
Annual report, 1895–1896. [1872, 1875–1877, 1879–1893.]
Agricultural Experiment Station Bulletins, 113–115, 1895–1896. [82–110.]
Department of Geology.
Bulletins, II, pts. 1–3, 1896. [Complete.]
Report of the viticultural work during the seasons of 1887–1893, with data regarding the vintages of 1894–1895. Sacramento, 1896. 8vo, 466 pp.
Resistant vines; their selection, adaptation and grafting. Arthur P. Hayne. Sacramento, 1897. 8vo, 53 pp.
University studies, II, pt. 1, 1897. [Complete.]

Mount Hamilton.
LICK OBSERVATORY.
Brief account of the Lick Observatory Ed. 2. E. S. Holden. Sacramento, 1895. 8vo, 29 pp.

Mount Hamilton—Continued.
LICK OBSERVATORY—Continued.
Cipher-code for astronomical messages. E. S. Holden. n. p. 1896, 8vo, p. 109–138. <Pub. Astron. Soc. of the Pacific, VIII, 1896.
Contributions from Lick Observatory. Nos. 1–2, 4, 1889–1893. [Complete.]

Oakland.
TOMPKINS SCHOOL.
Monographs, nos. 1–2, 1895–1896.

Sacramento.
CALIFORNIA STATE MINING BUREAU.
Bulletin, no. 11, 1897. [4-7.]
Catalogue of California fossils. J. G. Cooper.

San Diego.
OUT OF DOORS FOR WOMEN, I, pts. 3, 6–12, 1894 II, pts. 13–17, 19–20, 1895 III, pts. 22–29, 1896.

San Francisco.
STATE MINING JOURNAL, I, pts. 10, 12, 13–18, 21–31, 1896.

Santa Barbara.
SOCIETY OF NATURAL HISTORY.
Bulletin, I, 1887. [I, pt. 2, 1890.]

Colorado.

Colorado Springs.
COLORADO COLLEGE.
Studies, VI, 1896. [Complete.]

Denver.
COLORADO SCIENTIFIC SOCIETY.
Argon and helium in the periodic sequence. Chas. S. Palmer. Denver, 1897. 8vo, 10 pp.
Automatic water recording gauge. Ernest Le Neve Foster. Denver, 1896. 8vo, p. 1–4. <Proc. Colo. Sci. Soc., 1896.
Magnetic concentration applied to sulphide ore. G. M. Gouyard. Denver, 1897. 8vo, p. 1–11. <Proc. Colo. Sci. Soc., 1897.
Notes on the occurrence of a rich silver and gold mineral containing tellurium, in the Griffith Lode near Georgetown, Colo. Richard Pearce. Denver, 1896. 8vo, p. 2. <Proc. Colo. Sci. Soc., 1896.
Pearceite, a sulpharsenite of silver, and on the crystallization of polybasite. S. L. Penfield. n. p., n. d. 8vo, 15 pp.

Denver—Continued.

COLORADO SCIENTIFIC SOCIETY—C't'd.

Proceedings. II, pt. 3, 1887. [II, pts. 1–2.]

Recent assay balance. L. S. Austin. Denver, 1897. 8vo, 6 pp.

San Miguel formation. Igneous rocks of the Telluride district, Colo. n. p., n. d. 8vo, 18 pp.

Technical determination of iron. L. J. W. Jones. Denver, 1896. 8vo, 14 pp. <Proc. Colo. Sci. Soc., 1896.

Fort Collins.

COLORADO STATE AGRICULTURAL COLLEGE.

Annual catalogue, XVII, 1895.

COLORADO STATE BOARD OF AGRICULTURE.

Annual report, XVII, 1895.

Connecticut.

Middletown.

STORR'S AGRICULTURAL COLLEGE.

Annual report of trustees, 1896.

WESLEYAN UNIVERSITY.

Annual catalogue, 1896–1897. [1895–1896.]

New Haven.

YALE UNIVERSITY OBSERVATORY.

Report, 1895–1896.

Portland.

THE OBSERVER, VII, pts. 7–10, 1896. [I–V; VI, pts. 6, 9–12; VII, pts. 2–6.]

District of Columbia.

Washington.

AGRICULTURE, DEPARTMENT OF.

Bureau of Animal Industry.

Annual report, XII, XIII, 1895–1896. [X–XI.]

Bulletins, 5, 8, 9, 11, 13–17, 1893–1896.

Circular, nos. 1–17, 1893–1897.

Division of Ornithology and Mammalogy.

North American Fauna, nos. 11–12, 1895–1896. [1–5, 7–8, 10.]

Division of Publications.

List of publications for five years 1889–1893. Washington, 1894. 8vo, 42 pp.

Division of Statistics.

Circular, no. 3, 1896.

Report, miscellaneous ser. 2–8, 1892–1894.

Washington—Continued.

AGRICULTURE, DEPARTMENT OF—Continued.

Division of Vegetable Physiology and Pathology.

Bulletin, 10–11, 1896.

Farmers' Bulletin, nos. 32, 42, 43, 49–51, 53, 1895–1897.

Library Bulletin, nos. 12–19, 1896–1897. [1–4, 6–8, 10–11.]

Office of Experiment Stations.

Record, VII, pt. 10, 1896–1897. [Complete.]

Section of Foreign Markets.

Circular, 11, 1896. [8–9.]

Report of Secretary, 1896. [1889, 1891, 1893.]

Weather Bureau.

Bulletin, no. 11, pt. 3, 1896; 13, 1896. [1, 4–8, 10.]

Monthly Weather Review, XXIV, 1896; XXV, pts. 1–5, 1897. [XXI–XXIII.]

Year-book, 1895.

AMERICAN JEWISH HISTORICAL SOCIETY PUBLICATIONS, V, 1897. [Complete.]

AMERICAN MONTHLY MICROSCOPICAL JOURNAL. XVII, pts. 11–12, 1896; XVIII, pts. 1–10, 1896. [1, pt. II; 2, pt. 4; V, pts. 1–11; VI, pts. 1–9, 11–12; VII, pts. 2–6, 9–11, VIII–XVI; XVII, pts. 1–10.]

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

American Anthropologist, IX, pts. 7–12, 1896; X, pts. 1–6, 1897. [Complete.]

BIOLOGICAL SOCIETY OF WASHINGTON.

Proceedings, X, pp. 115–125, 131–167, 1897. [Complete.]

CENSUS BUREAU.

Report on the insane, feeble-minded, deaf and dumb, and blind in the United States. Washington, 1895. 4to, 755 pp.

Report on farms and homes: proprietorship and indebtedness in the United States, 1890. G. K. Holmes and J. S. Lord. Washington, 1896. 4to, 646 pp.

Report on vital and social statistics in the United States.

Pt. 2. Vital statistics. Cities of 100,000 population and upward. Washington, 1881. 4to, 1181 pp.

Washington—Continued.

Census Bureau—Continued.

Pt. 4. Statistics of deaths. Washington, 1895. 4to, 1033 pp.

Civil Service Commission.

Annual report, XII, 1894–1895.

Coast and Geodetic Survey.

Report, 1895. [1851–1866, 1868–1894.]

Education, Bureau of.

Report of the Commissioner, 1893–1896. [1884–1890, 1892.]

Report on the introduction of domestic reindeer into Alaska. Sheldon Jackson. No. 5, 1895.

Entomological Society of Washington.

Proceedings, III, pt. 5, 1895; IV, pt. 1, 1896. [Complete.]

Ethnology, Bureau of.

Aboriginal remains in Verde Valley, Arizona. Cosmos Mindeleff. Washington, 1896. 4to, p. 183–261. <13th Ann. Rep. Bur. Ethnol.

Annual report, 1896. [Complete.]

Haida grammar. C. Harrison. n. p., 1895. 8vo, p. 123–226. <Trans. Roy. Soc. Can., (2) v. 1.

Pueblo Indian clans. F. W. Hodge. Washington, 1896. 8vo, p. 345–352. <Amer. Anthropologist, Oct., 1896.

Fish Commission.

Annotated list of the fishes known from the state of Vermont. B. W. Evermann and W. C. Kendall. Washington, 1896. 8vo, p. 579–604. <Rep. U. S. Fish. Com., 1894.

Artificial propagation of the rainbow trout. George A. Seagle. Washington, 1896. 4to, p. 237–256. pls. 88–94. <Bull. U. S. Fish Com., 1896.

Artificial propagation of salmon on the Pacific coast of the United States with notes on the natural history of the Quinnat salmon. Livingston Stone. Washington, 1896. 4to, 15 pls. p. 205–235. <Bull. U. S. Fish Com., 1896.

Check-list of the fishes and fish-like vertebrates of North and Middle America. David Starr Jordan and B. W. Evermann. Washington, 1896. 8vo, p. 207–584. <Rep. U. S. Fish Com., 1895.

Washington—Continued.

Fish Commission—Continued.

Description of a closing tow-net. C. H. Townsend. Washington, 1896. 8vo, p. 279–282. pls. 9–10. <Rep. U. S. Fish Com., 1894.

Description of a new species of shad (*Alosa alabamæ*) from Alabama. B. W. Evermann. Washington, 1896. 8vo, p. 203–205. <Rep. U. S. Fish Com., 1895.

Fish and fisheries of the coastal waters of Florida. J. J. Brice. Washington, 1897. 8vo, pp. 263–342. <Rep. U. S. Fish Com., 1896.

Ichthyological collections of the U. S. Fish Commission Steamer *Albatross* during the years 1890 and 1891. Chas. H. Gilbert. Washington, 1896. 8 vo, p. 393-476. pls. 20–35. <Rep. U. S. Fish Com., 1893.

List of publications of the U. S. Fish Commission. Chas. W. Scudder. Washington, 1896. 8vo, p. 617–706. <Rep. U. S. Fish Com., 1894.

Notes on Biscayne bay, Florida, with reference to its adaptability as the site of a marine hatching and experiment station. Hugh M. Smith. Washington, 1896. 8vo, p. 169–191. <Rep. U. S. Fish Com., 1895.

Notes on the food of four species of the cod family. Wm. C. Kendall. Washington, 1897. 8vo, p. 177–186. <Rep. U. S. Fish Com., 1896.

Remarks on the movements and breeding grounds of the fur-seal. J. J. Brice. Washington, 1896. 8vo, p. 573–577. <Rep. U. S. Fish Com., 1894.

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SPECIAL BULLETIN.

Smithsonian Institution. | United States National Museum. | — | Special Bulletin. | — | Oceanic Ichthyology, | A Treatise on the Deep-sea and Pelagic | Fishes of the World, | Based chiefly upon | the collections made by the | steamers Blake, Albatross, | and Fish Hawk in the Northwestern Atlantic, | with | an atlas containing 417 figures, | By | George Brown Goode, Ph. D., LL. D., | Assistant Secretary, Smithsonian | Institution, in charge of U. S. National Museum, | and | Tarleton H. Bean, M. D., M. S., | Director of the New York Aquarium. | — | Washington: | Government Printing Office. | 1895.

Special Bull. No. 2, 4to, pp. I–XXXV, 1*–26*, 1–553; atlas, I–XXIII, 1*–26*, pls. I–CXXIII.

Smithsonian Institution. | United States National Museum. | Special Bulletin. | — | Life Histories | of | North American Birds, | From the Parrots to the Grackles, | with special reference to | their breeding habits and eggs, | By | Charles Bendire, Captain and Brevet Major, U. S. A. (Retired). | Honorary Curator of the Department of Oölogy, U. S. National Museum, | Member of the American Ornithologists' Union. | With seven lithographic plates. | —o— | Washington: | Government Printing Office. | 1895.

Special Bull. No. 3, 4to, pp. I–IX, 1–518, pls. I–VII.

BULLETIN.

Smithsonian Institution. | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 47. | — | The Fishes | of | North and Middle America: | A Descriptive | Catalogue of the Species of Fish-like Vertebrates found in the | Waters of North America, North of the Isthmus of Panama. | By | David Starr Jordan, Ph. D., | President of the Leland Stanford Junior University, | and | Barton Warren Evermann, Ph. D., | Ichthyol-

[1] The titles of the papers from the Report and Proceedings of the National Museum, which were published in separate form during the year, are given in Appendix V.

ogist of the United States Fish Commission. | Part I. | Washington: | Government Printing Office. | 1896. |
8vo, pp. I–LX, 1–1240.

Smithsonian Institution. | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 49. | Bibliography of the Published Writings of Philip | Lutley Sclater, F. R. S., Secretary of the | Zoological Society of London. | — | Prepared under the direction of | G. Brown Goode. | — | Washington: | Government Printing Office. | 1896.
8vo, pp. I–XIX, 1–135.

PAPERS BY OFFICERS OF THE NATIONAL MUSEUM AND OTHERS, BASED UPON MUSEUM MATERIAL.

ADLER, Cyrus. The Cotton Grotto—an ancient quarry in Jerusalem, with notes on ancient methods of quarrying.
Semitic Studies in memory of Reverend Doctor Alexander Kohut, Berlin, 1897, pp. 73–82.
An account of the quarry, in which reference is made to some objects discovered there by the writer in 1891. These objects are now in the National Museum.

ALLEN, Harrison. Notes on the vampire bat (*Diphylla ecaudata*), with special reference to its relationships with *Desmodus rufus*.
Proc. U. S. Nat. Mus., XVIII, No. 1099, Oct. 26, 1896, pp. 769–777, figs. 1–6.

—— Description of a new species of bat of the genus *Glossophaga*.
Proc. U. S. Nat. Mus., XVIII, No. 1100, Oct. 26, 1896, pp. 779–781.

AMERICAN ORNITHOLOGISTS' UNION. Eighth supplement to the American Ornithologists' Union check-list of North American birds.
Auk, XIV, No. 1, Jan., 1897, pp. 117–135.
This supplement was prepared by the committee on classification and nomenclature.
Twenty-four additional species and subspecies are admitted to the check-list, and the nomenclature of forty-one species and genera is more or less altered. Six forms described during the two preceding years are not considered worthy of recognition, and action on other cases is deferred from lack of material or information.

ANTHONY, A. W. Eggs of the Black, Socorro and Least Petrels.
Nidologist, IV, No. 2, Oct., 1896, pp. 16–17.

—— New birds from the islands and peninsula of Lower California.
Auk, XIV, No. 2, Apr., 1897, pp. 164–168.
The species and subspecies described as new are *Carpodacus mcgregori*, *Thryothorus cerroenis*, *and Harporhynchus lecontei arenicola*.

ASHMEAD, William H. A new parasitic bee.
Ent. News, VII, Sept., 1896, p. 218.
Describes *Stelis sexmaculatus*, n. sp., from California.

ASHMEAD, William H.—Continued.

—— On the genera of the Eupelminæ.
Proc. Ent. Soc. Wash., IV, Oct. 30, 1896, pp. 4–20.
The author gives a revised table of all known genera in this group, and describes nine new genera and sixteen new species. In all, twenty-eight genera are tabulated.

—— Rhopalosomidæ, a new family of fossorial wasps.
Proc. Ent. Soc. Wash., III, Oct., 1896, pp. 303–309.
This family is based upon the rare *Rhopalosoma poeyi* Cresson, originally described from Cuba, and placed by Cresson in the family Braconidæ and by Westwood in the family Vespidæ. Mr. Ashmead reports it now for the first time from the United States, gives a full bibliography, quotations from various authors as to its affinities, and his reasons for differing from other authorities and for considering it the type of a distinct family.

—— Descriptions of new cynipidous galls and gallwasps in the United States National Museum.
Proc. U. S. Nat. Mus., XIX, No. 1102, Dec. 30, 1896, pp. 113–136.
One new genus and forty-three new species of North American Cynipidæ are described.

—— A new *Hemiteles*.
Ent. News, VII, Dec., 1896, p. 320.
Describes *Hemiteles davidsonii*, n. sp.

—— The phylogeny of the Hymenoptera.
Proc. Ent. Soc. Wash., III, 1896, pp. 323–336.
In this paper Mr. Ashmead discusses quite extensively the origin and development of the Hymenoptera, gives diagrams showing the origin and affinities of the different families, and proposes a new classification of these insects.

—— *Nitelopterus*, a new Larrid genus.
Ent. News, VII, Jan., 1897, pp. 22–23.
Describes *Nitelopterus slossonæ* (new genus and species).

—— Descriptions of some new genera and species of Canadian Proctotrypidæ.
Can. Ent., XXIX, March, 1897, pp. 53–56.
Describes two new genera, *Scorpioteleia* and *Stylidolon*, and seven new species of Proctotrypidæ.

ASHMEAD, WILLIAM H.—Continued.

—— A new water-bug from Canada.

Can. Ent., XXIX, March, 1897, p. 56.

Describes *Halobatopsis beginii*, n. sp.

—— Descriptions of some new genera in the Cynipidæ.

Psyche, VIII, May, 1897, pp. 67–69.

Describes seven new genera and three new species.

This paper is based largely upon Museum material, and all types, except *Acanthaegilips*, are in the National Museum.

—— Two new parasites from *Eupoeya slossonæ*.

Can. Ent., XXIX, May, 1897, p. 113.

Describes *Pelecystoma eupoeyae* and *Cryptturus dyari*.

—— California bees and their parasites.

Proc. South. Cal. Acad. Sci., I, No. 3, 1897, pp. 3–7.

Describes a new bee and two parasites.

(See also under LELAND O. HOWARD.)

BAKER, E. G.

(See under JOSEPH NELSON ROSE.)

BARTSCH, PAUL. The wrens of Burlington, Iowa.

Iowa Ornithologist, No. 2, April, 1897, pp. 21–24.

Notes on five species of wrens found about Burlington, Iowa.

BEAN, BARTON A.

(See under TARLETON H. BEAN and BARTON W. EVERMANN.)

BEAN, TARLETON H., and BEAN, BARTON A. Contributions to the natural history of the Commander Islands, No. XII.—Fishes collected at Bering and Copper Islands by N. A. Grebnitski and Leonhard Stejneger.

Proc. U. S. Nat. Mus., XIX, No. 1106, Dec. 30, 1896, pp. 237–251.

A list of 45 species of fishes collected during the years 1882–1885.

—— Notes on fishes collected in Kamchatka and Japan by Leonhard Stejneger and N. A. Grebnitski, with a description of a new Blenny.

Proc. U. S. Nat. Mus., XIX, No. 1112, Jan. 27, 1897, pp. 381–392, pls. XXXIV, XXXV.

This paper lists and describes a number of interesting fishes obtained in Kamchatka during the fall of 1883, and in Yesso, Japan, in 1894, including a new genus of Blenny (*Pholidapus grebnitskii*), from Yesso.

—— Description of a new Blenny-like fish of the genus *Opisthocentrus*, collected in Vulcano Bay, Port Mororan, Japan, by N. A. Grebnitski.

Proc. U. S. Nat. Mus., XX, No. 1127, Jan. 28, 1897. Advance edition p. [1].

BEAN, TARLETON H.

(See also under G. BROWN GOODE.)

BECK, R. H. Western Evening Grosbeak.

Nidologist, IV, No. 1, Sept., 1896, pp. 3–4, 1 pl.

BENDIRE, CHARLES. Smithsonian Institution. | United States National Museum. | Special Bulletin. | — | Life Histories | of | North American Birds, | From the Parrots to the Grackles, | With special reference to | Their Breeding Habits and Eggs, | By | Charles Bendire, Captain and Brevet Major, U. S. A. (Retired). | Honorary Curator of the Department of Oölogy, U. S. National Museum, | Member of the American Ornithologists' Union. | With | seven lithographic plates. | — | Washington: | Government Printing Office. | 1895.

Special Bull. No. 3, 4to, pp. I–IX, 1–518, pls. I–VII.

BENEDICT, JAMES E. Preliminary descriptions of a new genus and three new species of crustaceans from an artesian well at San Marcos, Texas.

Proc. U. S. Nat. Mus., XVIII, No. 1087, 1896, pp. 615–617.

Describes 3 blind crustaceans, a shrimp, an isopod and an amphipod, taken by the U. S. Fish Commission from an artesian well, 188 feet deep, at San Marcos, Texas.

An advance edition of this paper was published Apr. 14, 1896.

BERGH, RUDOLPH. Beiträge zur Kenntniss der Coniden.

Nova Acta der Ksl. Leop.-Carol. Deutsch Acad. der Naturforscher, LXV, No. 2, 1896, pp. 69–214, pls. 1–13.

An anatomical study of the family Conidæ, in which it is shown that its characters are very uniform, and that, as far as there are differences, they do not march with the superficial shell characters upon which it has been sought to divide the group.

CASANOWICZ, I. M. Tell-et-Tin on Lake Homis, in the valley of the Orontes.

Am. Anthropologist, X, Jan., 1897, pp. 13–16.

A sketch of the geographical, anthropological and archæological features of that region.

CHITTENDEN, FRANK H. A new grain beetle.

Can. Ent., XXVIII, Aug., 1896, pp. 197–198.

Gives notes on some grain beetles belonging to the genus *Sylvanus*, and a table for distinguishing the species.

COGNIAUX, ALFRED. *Roseanthus*, a new genus of Curcurbitaceæ from Acapulco, Mexico.

Contrib. U. S. Nat. Herbarium, III, No. 9, Aug. 5, 1896, pp. 577–578, pl. 28.

A new genus named for Dr. J. N. Rose.

COQUILLETT, DANIEL W. A new subfamily of Ephydridæ.

Ent. News, VII, Sept., 1896, pp. 220–221.

Describes *Lipochaeta slossonae*, new genus and species.

—— A new Dipterous genus related to *Gnoriste*.

Proc. Ent. Soc. Wash., III, Oct., 1896, pp. 321–322.

Describes *Eugnoriste occidentalis*.

—— A Dipterous parasite of spiders' eggs.

Ent. News, VII, Dec., 1896, p. 320.

Describes *Gaurax araneae*, n. sp.

COUES, ELLIOTT. *Ammodramus* (*Passerculus*) *sanctorum*.

Auk, XIV, No. 1, Jan., 1897, pp. 92–93.

Mentions the rediscovery of this species on San Benito Island—the type locality—by Mr. A. W. Anthony, and its validity as a species is affirmed. Some remarks are added on the genus *Passerculus*, and the name *Ammodramus* (*Passerculus*) *sandwichensis wilsonianus* is proposed, to replace *A. sandwichensis savanna*.

—— *Uria lomvia* in South Carolina.

Auk, XIV, No. 2, Apr., 1897, pp. 202–203.

Records the capture of a Brünnich's Murre near Anderson, S. C.

COULTER, JOHN M., and ROSE, JOSEPH NELSON. *Leibergia*, a new genus of Umbelliferæ from the Columbia River region.

Contrib. U. S. Nat. Herbarium, III, No. 9, Aug. 5, 1896, pp. 575–576.

This new genus is named in honor of J. B. Leiberg, Hope, Idaho.

COVILLE, FREDERICK VERNON. *Crepis occidentalis* and its allies.

Contrib. U. S. Nat. Herbarium, III, No. 9, Aug. 5, 1896, pp. 559–565, pls. 22, 24, 25.

—— *Juncus confusus*, a new rush from the Rocky Mountain region.

Proc. Biol. Soc. Wash., X, Nov. 14, 1896, pp. 127–130.

—— *Ribes erythrocarpum*, a new currant from the vicinity of Crater Lake, Oregon.

Proc. Biol. Soc. Wash., X, Nov. 14, 1896, pp. 131–132.

—— The National Herbarium and the Division of Botany.

Botan. Gaz., XXII, Nov. 23, 1896, pp. 418–420.

COVILLE, FREDERICK VERNON—Cont'd.

—— *Collomia mazama*, a new plant from the vicinity of Crater Lake, Oregon.

Proc. Biol. Soc. Wash., XI, Mar. 13, 1897, pp. 35–37, pl. 1.

—— The itinerary of John Jeffrey, an early botanical explorer of western North America.

Proc. Biol. Soc. Wash., XI, Mar. 23, 1897, pp. 57–60.

—— The technical name of the *Camas* plant.

Proc. Biol. Soc. Wash., XI, Apr. 21, 1897, pp. 61–65.

—— Two new plants from Mount Mazama, Oregon.

Proc. Biol. Soc. Wash., XI, June 9, 1897, pp. 169–171.

COX, ULYSSES O.

(See under BARTON W. EVERMANN.)

CRAMER, FRANK.

(See under CHARLES HENRY GILBERT.)

CULIN, STEWART. Mancala: The national game of Africa.

Rep. Smithsonian Inst. (U. S. Nat. Mus.) 1894 (1897), pp. 595–607, pls. I–V, figs. 1–15.

DALL, WILLIAM HEALEY. On the American species of *Ervilia*.

Nautilus, X, No. 3, July, 1896, pp. 25–27.

This summary enumerates the species and gives their distinctive characters. *Ervilia maculosa* Dall, from off Cape Lookout, North Carolina, is described as new.

—— The mollusks and brachiopods of the Bahama Expedition of the State University of Iowa.

Nat. Hist. Bull. State Univ. Iowa, IV, No. 1, Aug. 20, 1896, pp. 12–27, pl. 1.

This paper enumerates the species collected, most of which are represented in the National Museum, and describes and figures as new *Murex nuttingi* Dall, Sand Key, Fla.; *Cerion* (*Maynardia*) *niteloides* Dall, Water Cay, Bahamas; *Liotia centrifuga* Dall, Strait of Florida; and *Carditella smithii* Dall, Bermuda. The types are in the National Museum and the State University of Iowa.

—— Insular land-shell faunas, especially as illustrated by the data obtained by Dr. C. Baur in the Galapagos Islands.

Proc. Acad. Nat. Sci. Phila., for Aug., 1896, pp. 395–497, pls. XV–XVII.

This memoir discusses the conditions under which land-shells exist in the Galapagos, St. Helena and other oceanic volcanic islands; summarizes the history of their exploration; tabulates the distribution of the Galapagos species among the several islands, and in the different life-zones on single islands, and offers

DALL, WILLIAM HEALEY—Continued.

data showing the direct influence of similar conditions upon individuals of diverse origin, and the similarity of effects produced by the same causes in widely different regions and upon forms of different genetic origin. The relations of the St. Helena *Pachyotus* are shown by anatomical data to be with the West African *Achatinas*, notwithstanding their wide testaceous divergence. The *Nesiotes* of the Galapagos on the other hand are related to North and Central American *Bulimulus*. The Galapagos land-shells are enumerated, their anatomical characters elucidated, and their synonymy worked out. The genitalia, dentition and jaws of numerous species, and the unfigured shells of previously described species are illustrated. *Bulimulus nesioticus* Dall is described as new. The paper concludes with a bibliography of the Galapagos land-shell literature.

—— Cook's Inlet and the region to the westward.

Bull. U. S. Coast and Geod. Surv. No. 35, Aug., 1896, pp. 162–170.

This article contains a summary of geographical and other notes on the region, made during official explorations in the summer of 1895.

—— On the American species of *Cyrenoidea*.

Nautilus, x, No. 5, Sept., 1896, pp. 51–52.

Three American species are known, besides the original type from Senegal, of which *Cyrenoidea floridana* Dall, and *C. caloosaënsis* Dall are described as new. The types are in the U. S. National Museum.

—— Recent advances in malacology.

Science (New series), IV, No. 100, Nov. 27, 1896, pp. 770–773.

This article contains a summary of recent malacological work not yet incorporated in the textbooks. It is based in part on work done in the U. S. National Museum.

—— Pelecypoda.

Textbook of Paleontology, by K. A. von Zittel, revised edition, I, 1896, pp. 346–429.

In this contribution to the revised Textbook the entire text has been rewritten, the classification has been changed, the bibliography brought up to date, and the modern view of most of the subjects included. The subgenus of *Lucina*, *Prolucina* Dall, of the Silurian, is described as new.

—— Report on the mollusks collected by the International Boundary Commission of the United States and Mexico, 1892–1894.

Proc. U. S. Nat. Mus., XIX, No. 1111, Jan. 27, 1897, pp. 333–349, pl. XXXI–XXXIII.

This paper treats of the species chiefly collected by Dr. E. A. Mearns, U. S. A., in the region referred to; summarizes the results of previous work in the same region; illustrates unfigured species; describes as new, *Polygyra ashmuni* Dall, *P. pseudodonta* Dall, *Bulimulus nigromontanus* Dall and *Streptostyla nebulosa* Dall; discusses the subdivision of the genus *Holospira*, and catalogues the known species. *Coelocentrum nelsoni* Dall, *C. pfefferi* Dall, and *Anisospira strebeli* Dall are described as new from specimens obtained by E. W. Nelson. A list of the known pulmonate fauna of the region is given, and also a list of marine mollusks collected at or near the western termination of the boundary line.

—— List of species of shells collected at Bahia, Brazil, by Dr. H. von Ihering.

Nautilus, x, No. 11, March, 1897, pp. 121–123.

This paper enumerates, from specimens sent to the National Museum, the marine shells collected at Bahia, Brazil, showing that many of them are typically Antillean species. *Mactrella iheringi* Dall, is described as new.

—— Report on the coal and lignite of Alaska.

17th Ann. Rep., U. S. Geol. Surv., 1896, (March, 1897), pp. 763-908, pls. XLVIII–LVIII.

This report summarizes what was previously known in regard to the deposits of coal and lignite in Alaska, also the results of explorations by the author and Dr. G. F. Becker in the summer of 1895. The Tertiary rocks of Alaska are discussed, and a table of the invertebrate fossils known from them, derived from material in the U. S. National Museum, is given. These are followed by appendices by F. H. Knowlton on the Paleobotany, Charles Schuchert on the Paleozoic fossils, and Alpheus Hyatt on the Mesozoic fossils. A list of all Alaskan species of fossil plants and a table of their known distribution is given by Mr. Knowlton; Mr. Schuchert catalogues the known Carboniferous and Devonian fossils of Alaska and describes as new, variety *alaskensis*, of the Carboniferous *Productus longispinus*; Professor Hyatt points out the generally Jurassic character of the Mesozoic fossils, and the absence so far of well defined Cretaceous beds in Alaska. The material upon which the reports are based is in the National Museum.

—— Distribution of marine mammals.

Science (New series), V, No. 126, May 28, 1897, p. 84?.

This note calls attention to the presence in Bering Sea, the North Pacific and the Galapagos Islands, of certain marine mammals omitted in some recent discussions of geographical distribution.

—— Synopsis of the Pinnidæ of the United States.

Nautilus, XI, No. 3, 1897, pp. 25–26.

This paper revises the synonymy and enumerates the species native to the Atlantic Coast of the United States and adjacent regions.

(See also under R. J. LECHMERE GUPPY.)

DEWEY, LYSTER H. The genus *Avena* on the Pacific coast.

Erythea, V, Feb., 1897, p. 29.

A note in regard to different species mistaken for *Avena fatua*.

—— The eastward migration of certain weeds in America.

Asa Gray Bulletin, V, June 11, 1897, pp. 31–34, 1 map.

DWIGHT, JONATHAN. A species of Shearwater (*Puffinus assimilis* Gould) new to the North American fauna.

Proc. Biol. Soc. Wash., XI, April 21, 1897, pp. 69–70.

A specimen of a shearwater obtained at Table Island, Nova Scotia, in the autumn of 1896, is referred to this species, which has not before been recorded from North America. A description of the specimen and some comments on earlier descriptions are given.

EICHHOFF, WILLIAM. Remarks on the synonymy of some North American Scolytid Beetles.

Proc. U. S. Nat. Mus., XVIII, No. 1085, Aug. 12, 1896, pp. 605–610.

EVERMANN, BARTON W. Description of a new species of shad (*Alosa alabamæ*) from Alabama.

Rep. U. S. Fish Com., 1895 (appendix 4, Dec. 28, 1896), pp. 203–205.

EVERMANN, BARTON W., and BEAN, BARTON A. Indian River and its fishes.

Senate Doc. No. 46, 54th Cong., 2nd sess., Jan., 1897, pp. 5–26, pls. 1–37.

In this paper 106 species of fishes known to occur in the Indian River, Florida, are listed. Based upon collections made by the writers in January, 1896, and upon those already in the National Museum.

EVERMANN, BARTON W., and COX, ULYSSES O. Report upon the fishes of the Missouri River Basin.

Rep. U. S. Fish Com., 1894 (extract, Nov. 27, 1896), pp. 325–429.

A descriptive list of the fishes of the Missouri River and its tributaries.

EVERMANN, BARTON W., and KENDALL, W. C. An annotated list of the fishes known from the state of Vermont.

Rep. U. S. Fish Com., 1894 (extract, 1896), pp. 579–604.

This paper is based chiefly upon observations and collections made in July, 1894, by the senior author and Mr. Barton A. Bean. It is a report upon the species of fishes collected or known to occur in the waters of Vermont. Fifty-three species are recorded.

EVERMANN, BARTON W., and SMITH, HUGH M. The Whitefishes of North America.

Rep. U. S. Fish Com., 1894 (extract, 1896), pp. 283–324, pls. 11–28.

A critical review of the Whitefishes found in the waters of North America.

(See also under DAVID STARR JORDAN.)

FEWKES, J. WALTER. Two ruins recently discovered in the Red Rock Country, Arizona.

Am. Anthropologist, IX, Aug., 1896, pp. 263–283.

An article showing that cliff-house culture is not a stage in architectural development, but an adaptive condition.

—— Pacific Coast shells from prehistoric Tusayan pueblos.

Am. Anthropologist, Nov., 1896, pp. 359–367, pls. VIII, IX.

This article discusses the occurrence of marine shells in ruins along the Little Colorado River, in Arizona.

—— The sacrificial element in Hopi worship.

Journ. Am. Folk Lore, X, 1896, No. XXXVIII, pp. 187–201.

—— The Micoñinovi flute altars.

Journ. Am. Folk Lore, IX, 1896, No. XXXV, pp. 241–255, pls. I, II.

An illustrated description of two altars erected by the Flute Society in one of the Hopi pueblos.

—— Tusayan totemic signatures.

Am. Anthropologist, X, Jan., 1897, pp. 1–11, pls. II–IV.

A list of the "marks" or totems of the leading men of the Hopi pueblos.

—— Morphology of Tusayan altars.

Am. Anthropologist, X, May, 1897, pp. 129–145, figs. 1–5.

An article showing the similarity of altars of apparently different character, and that the dominating symbolism upon them refers to rain and the growth of corn.

—— Preliminary account of an expedition to the cliff villages of the Red Rock country, and the Tusayan ruins of Sikyatki and Awatobi, Arizona, in 1895.

Rep. Smithsonian Inst., 1895 (1897), pp. 557–588, pls. XXXV–LXVII.

This article describes new ruins discovered in 1895, and the objects found in them.

—— The Tusayan ritual: A study of the influence of environment on aboriginal cults.

Rep. Smithsonian Inst., 1895 (1897), pp. 683–700, pls. LXX–LXXIII.

It is shown that the arid climate of Arizona

FEWKES, J. WALTER—Continued.
has developed a ritual among pueblos in which ceremonies for rain and the growth of corn are dominant.

—— Tusayan snake ceremonies.

16th Ann. Rep. Bur. Am. Ethnol., 1897, pp. 266-311, pls. LXX-LXXXI.

An account of the snake dances at Oraibi and the pueblos of the Middle Mesa of the Hopi.

FIGGINS, J. D. Bachman's sparrow in Maryland.

Auk, XIV, No. 2, April, 1897, p. 219.

Bachman's sparrow is here, for the first time, reported from Maryland, based on a specimen shot near Kensington.

GILBERT, CHARLES HENRY. The ichthylogical collections of the U. S. Fish Commission steamer *Albatross* during the years 1890 and 1891.

Rep. U. S. Fish Com., 1893 (extract Dec. 9, 1896), pp. 393-476, pls. 20-35.

—— Descriptions of twenty-two new species of fishes collected by the steamer *Albatross* of the United States Fish Commission.

Proc. U. S. Nat. Mus., XIX, No. 1115, Feb. 5, 1897, pp 437-457, pls. XLIX-LV.

Based upon collections of the Museum, made for the most part in the Pacific Ocean, south of Santa Barbara, Cal. Several of the species are from the Galapagos Archipelago, one only being from the Atlantic.

GILBERT, CHARLES HENRY, and CRAMER, FRANK. Report on the fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species.

Proc. U. S. Nat. Mus., XIX, No. 1114, Feb. 5, 1897, pp. 403-435, pls. XXXVI-XLVIII.

GOODE, GEORGE BROWN, and BEAN, TARLETON H. Smithsonian Institution. | United States National Museum. | — | Special Bulletin | — | Oceanic Ichthyology, | A Treatise on the | Deep-sea and Pelagic Fishes of the World, | Based chiefly upon | The collections made by the steamers *Blake*, *Albatross*, | and *Fish Hawk* in the Northwestern Atlantic, | with | an Atlas containing 417 figures, | By | George Brown Goode, Ph. D., LL. D., | Assistant Secretary, Smithsonian Institution, in charge of U. S. National Museum, | and | Tarleton H. Bean, M. D., M. S., | Director of the New York Aquarium. |

GOODE, GEORGE BROWN, and BEAN, TARLETON H.—Continued.
— | Washington: | Government Printing Office. | 1895 (1896).

Special Bull. No. 2, 4to, pp. I-XXXV, 1*-26*, 1-553; Atlas, I-XXIII, 1*-26*, pls. I-CXXIII.

GOODE, GEORGE BROWN. Smithsonian Institution. | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 49. | Bibliography of the Published Writings of Philip | Lutley Sclater, F. R. S., Secretary of the | Zoological Society of London. | — | Prepared under the direction of | G. Brown Goode. | — | Washington: | Government Printing Office. | 1896.

8vo., pp. I-XIX, 1-135.

—— Philip Lutley Sclater.

Science (New series), IV, 1896, No. 88, pp. 293-298.

—— Report upon the condition and progress of the U. S. National Museum during the year ending June 30, 1894.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1894 (1897), pp. 1-233.

GUPPY, R. J. LECHMERE and DALL, WILLIAM HEALEY. Descriptions of Tertiary fossils from the Antillean region.

Proc. U. S. Nat. Mus., XIX, No. 1110, Dec. 30, 1896, pp. 303-331, pl. XXVII-XXX.

This paper opens with a summary of the Antillean Tertiary horizons, from which material has been obtained, followed by descriptions of species, chiefly Oligocene, which are believed to be new. Of these Mr. Guppy describes forty-three and Mr. Dall eighteen new species. The genus *Strongylocera* (Mörch) is elucidated, the genus *Strombinella* Dall and the subgenus (of *Aclis*) *Amblyspira* Dall, are described as new, and the subgenus (of *Crassatellites*) *Crassinella* Guppy is reinstated. Fifty-nine species are figured.

HASSALL, ALBERT.
(See under CHARLES WARDELL STILES.)

HEMSLEY, W. BOTTING. *Eryngium longipetiolatum.*

Hooker's Icon. Plant., VI, pt. 1, ser. 4, Feb., 1897, pl. 2504.

An umbellifer, from near San Cristobal, Chiapas, Mexico.

—— *Eryngium paucisquamosum.*

Hooker's Icon. Plant., VI, pt. 1, ser. 4, Feb., 1897, pl. 2505.

An umbellifer, from the mountains near Hapancingo and summit of Sierra Madre, Mexico.

HEMSLEY, W. BOTTING—Continued.

—— *Eryngium spiculosum.*

Hooker's Icon. Plant., VI, pt. 1, ser. 4, Feb., 1897. pl. 2507.

An umbellifer from Mexico.

—— *Eryngium galeottii.*

Hooker's Icon. Plant., VI, pt. 1, ser. 4, Feb., 1897, pl. 2510.

An umbellifer from Oaxaca, Mexico.

(See also under JOSEPH NELSON ROSE.

HITCHCOCK, A. S. Flora of southwestern Kansas. Report on a collection of plants made by C. H. Thompson in 1883.

Contrib. U. S. Nat. Herbarium, III, No. 9, Aug. 5, 1886, pp. 537-557.

HOLLAND, W. J. List of the Lepidoptera collected in East Africa, 1894, by Mr. William Astor Chanler and Lieutenant Ludwig von Höhnel.

Proc. U. S. Nat. Mus., XVIII, No. 1098, Oct. 7, 1896, pp. 741-767.

HOUGH, WALTER. The Hopi in relation to their plant environment.

Am. Anthropologist, X, Feb., 1897, pp. 33-44.

This paper presents the results of the study of ethno-botanical collections made by the author while with the Fewkes expedition of 1896. The close relation of Hopi culture to the plant environment is revealed, and the native names and uses of more than 140 plants are given in a classified list.

HOWARD, LELAND O. Sulla *Scutellista cyanea* Motsch.

Revista di Patologia Vegetale, V, 1, July, 1896, pp. 1-7.

A consideration of the literature of this species, with re-descriptions, including first description of the male, and an account of its habits.

—— Shade tree insect problem in the United States.

Scientific American Supplement, XLII, No. 1075, Aug. 8, 1896, pp. 17178-17179; No. 1076, Aug. 15, 1896, pp. 17194-17195; No. 1077, Aug. 22, 1896, pp. 17220-17221, figs. 1-11.

Reprint of an article in the Yearbook of the U. S. Department of Agriculture for 1895, pp. 361-384, with reproductions of eleven figures.

—— The larger Corn-stalk borer (*Diatræa saccharalis* Fab.).

Circ. Div. Ent. U. S. Dept. Agric. (Series 2), No. 16, Aug. 13, 1896, 3 pp., 3 figs.

General appearance and methods of work; distribution; natural history and habits; amount of damage; remedies.

HOWARD, LELAND O.—Continued.

—— A Coleopterous enemy of *Corydalis cornutus.*

Proc. Ent. Soc. Wash., III, No. 5, Oct. 6, 1896, pp. 310-313.

Describes wholesale destruction of egg-masses of *Corydalis cornutus* by the larvæ and adults of *Anthicus haldemani* Casey, along the shores of the Potomac River during the year 1895. The first insect enemy of the *Corydalis* to be noted.

—— On some scale insects.

Trans. Mass. Hort. Soc., Boston (Extract, Oct. 25, 1896), 15 pp., 8 figs.

A general account of scale insects, with special reference to the species existing in Massachusetts or liable to be introduced; remedies; the nursery question; legislation.

—— The largest insect egg.

Ent. News, VII, No. 8, Oct., 1896, p. 244.

Measurements of the egg of *Sternocera orissa* from the South African Republic, which show it to be the largest insect egg yet discovered.

—— Some temperature effects on household insects.

Proc. Sixth Ann. Meeting American Warehousemen's Association, Boston, Mass., 1896.

This paper was reprinted in *Bull. Div. Ent. U. S. Dept. Agric.*, No. 6, Dec. 28, 1896, pp. 13-17.

Records of the effects of low temperatures upon the different stages of *Tinea biselliella*, *Attagenus piceus*, *Dermestes vulpinus*, *Tenebrio obscurus* and *Trogoderma tarsale.*

—— The insects which affect the cotton plant in the United States.

Bull. Office Experiment Stations, U. S. Dept. Agric., No. 33, Dec. 28, 1896, pp. 317-380, figs. 10-29, 1 pl.

This paper was reprinted, with changes, as *Farmers' Bulletin No. 47, U. S. Dept. Agric.*, Jan., 1897.

A consideration of the principal insects which affect the cotton plant in the United States.

—— Some insects affecting the hop plant.

Bull. Div. Ent., U. S. Dept. Agric. (New series) No. 7, Feb., 1897, pp. 40-51, 4 figs.

A consideration of the life history and habits of *Hydrœcia immanis*, *Hypena humuli*, *Polygonia interrogationsis* and *Polygonia comma.*

—— A case of excessive parasitism.

Bull. Div. Ent., U. S. Dept. Agric. (New series) No. 7, Feb., 1897, pp. 62-63.

Record of breeding of seven species of Chalcididæ with numbers and names from *Lecanium fletcheri* from Ottawa, Canada, and a description of one new species.

—— General notes and notes from correspondence.

Bull. Div. Ent. U. S. Dept. Agric. (New series) No. 7, Feb., 1897, pp. 76-87, 1 fig.

HOWARD, LELAND O.—Continued.

—— A study in insect parasitism: A consideration of the parasites of the white-marked tussock moth, with an account of their habits and interrelations, and with descriptions of new species.

Tech. Ser. Div. Ent., U. S. Dept. Agric., No. 5, Apr. 1, 1897, p. 57, fig. 24.

Contains a consideration of thirty-five species of parasitic Hymenoptera and nine species of Diptera, nine of the Hymenoptera being new.

—— On the Chalcididæ of the Island of Grenada, British West Indies.

Journ. Linn. Soc. Zool., XXVI, 1897, pp. 129–178.

Author's extras of this paper were published June 1, 1897.

One hundred and thirty-two species are considered, including descriptions of seventy-two new species and six new genera. Material on which this paper is based was collected by Herbert H. Smith under the auspices of British West India Committee, British Association for the Advancement of Science. A duplicate series will be deposited in the U. S. National Museum.

HOWARD, LELAND O., and ASHMEAD, WILLIAM H. On some reared Hymenopterous insects from Ceylon.

Proc. U. S. Nat. Mus., XVIII, No. 1092, Aug. 12, 1896, pp. 633–648.

Descriptions of thirty-two new species of Hymenopterous insects reared from their hosts by E. Ernest Green, Punduloya, Ceylon. Three new genera and sixteen new species are described by Doctor Howard. One new genus and seven new species are described by Mr. Ashmead.

HOWARD, LELAND O., and MARLATT, C. L. The principal household insects of the United States, with a chapter on insects affecting dry vegetable foods, by F. H. Chittenden.

Bull. Div. Ent., U. S. Dept. Agric. (New series) No. 4, 1896, pp. 1–130, fig. 62.

JORDAN, DAVID STARR, and EVERMANN, BARTON WARREN. Smithsonian Institution. | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 47. | — | The Fishes | of | North and Middle America: | A descriptive catalogue of the species of fish-like vertebrates found in the | waters of North America, north of the Isthmus of Panama. | By | David Starr Jordan, Ph. D., | President of the Leland Stanford Junior University, | and | Barton Warren Evermann, Ph. D., | Ichthyologist of the United States Fish Commission. | Part I. | Washington: | Government Printing Office. | 1896. |

8vo, pp. I–LX, 1–1240.

—— A check-list of the fishes and fish-like vertebrates of North and Middle America.

Rep. U. S. Fish Com., 1895 (appendix 5, Dec. 28, 1896), pp. 207–584.

A list of all the species of fishes and fish-like vertebrates thus far recorded as occurring in American waters north of the Isthmus of Panama.

JUDD, SYLVESTER D. Descriptions of three species of Sand Fleas (Amphipods) collected at Newport, Rhode Island.

Proc. U. S. Nat. Mus., XVIII, No. 1084, July 25, 1896, pp. 593–603, figs. 1–11.

Based on studies made while at Mr. Agassiz's marine laboratory at Newport, in the summer of 1893. The species described are *Calliopius rathkei* (Zaddach), *Byblis serrata* Smith and *B. agassizi*, sp. nov.

JUDSON, W. B. The White-throated Swift.

Nidologist, IV, No. 8, April, 1897, pp. 91–92.

A paper read by Mr. Judson at the meeting of the Cooper Ornithological Club (Southern Division), Pasadena, California, Jan. 27, 1897.

KENDALL, W. C. Description of a new Stickleback (*Gasterosteus gladiunculus*) from the coast of Maine.

Proc. U. S. Nat. Mus., XVIII, No. 1089, Aug. 12, 1896, p. 623.

(See also under BARTON W. EVERMANN.)

KNOWLTON, FRANK HALL. The genus *Nestor*.

Osprey, I, No. 3, Nov., 1896, pp. 31–33.

A popular account of the parrots of the genus *Nestor*. Illustrations of the sheep-eating species and the rare Philip Island parrot are given.

—— Report on the fossil plants collected in Alaska in 1895, as well as an enumeration of those previously known from the same region, with a table showing their relative distribution.

17th Ann. Rep. U. S. Geol. Surv., 1895–96 (1897), pp. 876–897.

(See also under TIMOTHY W. STANTON.)

LANO, ALBERT. *Buteo borealis harlani* in Minnesota.

Auk, XIII, No. 4, Oct., 1896, p. 342.

Note on the occurrence of Harlan's hawk in Minnesota.

LEIBERG, JOHN B. *Delphinium viridescens* and *Sambucus leiosperma*, two new plants from the northwest coast.

Proc. Biol. Soc. Wash., XI, March 13, 1897, pp. 39–41.

LINELL, MARTIN L. List of Coleoptera collected on the Tana River, and on the Jombéné Range, East Africa, by Mr. William Astor Chanler and Lieutenant Ludwig von Höhnel, with descriptions of new genera and species.

Proc. U. S. Nat. Mus., XVIII, No. 1094, Aug. 12, 1896, pp. 687–716.

—— New species of North American Coleoptera of the family Scarabæidæ.

Proc. U. S. Nat. Mus., XVIII, No. 1096, Oct. 7, 1896, pp. 721–731.

Describes one new genus and sixteen new species, and makes critical remarks on other species.

—— A short review of the Chrysomelas of North America.

Journ. N. Y. Ent. Soc., IV, Dec., 1896, pp. 195–200.

Gives tables of the genera and species of North American Chrysomelas found in the United States, and indicates one new subspecies, *Calligrapha californica*.

—— Descriptions of North American Coleoptera in the families Cerambycidæ and Scarabæidæ.

Proc. U. S. Nat. Mus., XIX, No. 1113, Feb. 5, 1897, pp. 393–401.

Describes one new genus and twelve new species, and makes critical observations on some described species.

—— On the insects collected by Dr. Abbott on the Seychelles, Aldabra, Gloriosa and Providence Islands, with descriptions of nine new species of Coleoptera.

Proc. U. S. Nat. Mus., XIX, No. 1119, May 13, 1897, pp. 695–706.

Gives a list of the insects taken in the different islands, makes remarks respecting their distribution, and describes nine new species of Coleoptera.

—— New genera and species of North American Curculionidæ.

Journ. N. Y. Ent. Soc., V, June, 1897, pp. 49–56.

Describes two new genera and twelve new species.

—— A new, nearly blind genus of Tenebrionidæ.

Ent. News, VIII, June, 1897, pp. 154–156.

Describes *Typhlusechus singularis*, new genus and species.

LÖNNBERG, EINAR. Is the Florida Box Tortoise a distinct species?

Proc. U. S. Nat. Mus., XIX, No. 1107, Dec. 30, 1896, pp. 253–254.

LUCAS, FREDERIC AUGUSTUS. Contributions to the natural history of the Commander Islands. XI.—The cranium of Pallas's Cormorant.

Proc. U. S. Nat. Mus., XVIII, No. 1095, Oct. 7, 1896, pp. 717–719, pls. XXXIV, XXXV.

—— A dog of the ancient pueblos.

Science (New series), V, No. 118, April 2, 1897, p. 544.

Description of a skull of a dog of a well-marked breed, from the ancient pueblo of Homolobi.

McGUIRE, JOSEPH D. Classification and development of primitive implements.

Am. Anthropologist, IX, July, 1896, pp. 227–237.

—— A study of the primitive methods of drilling.

Rep. Smithsonian Inst. (U. S. Nat. Mus.) 1894 (1897), pp. 623–756, figs. 1–201.

McNEILL, JEROME. Revision of the Truxalinæ of North America.

Proc. Davenport Acad. Nat. Sci., VI, 1896–1897, pp. 179–274.

Contains a revision of the genera and species of the North American subfamily Truxalinæ, gives a key to the subfamilies of the Acrididæ, the important characters used in this classification, a full bibliography of North American writers, together with tables and full descriptions of all the genera and species. Eleven new genera and nine new species are described.

MARLATT, C. L. A house-infesting Springtail.

Can. Ent., XXVIII, Sept., 1896, p. 219.

Describes *Lepidocyrtus americana*, n. sp.

(See also under LELAND O. HOWARD.)

MASON, OTIS T. Rochefort on the Caribbeans.

Science (New series), IV, July 10, 1896, p. 52.

This paper calls attention to the mention of the Cushing pile dwellings in San Marco, Florida, as far back as 1666.

—— Eskimo throwing-sticks.

Nature, London, July 23, 1896, p. 271.

A hitherto unknown form from Prince William Sound, Alaska is identified.

—— On lifting monoliths.

Science (New series), IV, Aug. 21, 1896, p. 228.

It is shown by the author that all the great stones in human art were cut and put in place in pre-mechanical times.

MASON, OTIS T.—Continued.

—— On the Siberian origin of Alaskan iron and copper daggers.

Verhandl. Berliner Gessellschaft für Anthrop, &c., Berlin, 1896, XXVIII, p. 75.

The copper and steel double-pointed and single-pointed daggers of the southeastern Alaskan Indians are compared with forms of the Bronze Age found in Siberia.

—— Matto Grosso, South America, as a mingling ground of stocks.

Science (New series), V. Jan. 29, 1897, p. 194.

This paper reveals the work of Dr. Hermann Meyer on the distribution of Eastern, Western, and South American bows and arrows and their commingling in the middle ground of the Matto Grosso.

—— The antiquity of certain curved knives.

Nature, London, April 8, 1897, p. 534.

The author describes the whittling knives introduced into America by whites, and seeks to find their distribution in the old world.

—— Tape and belt loom from Italy and its congeners in America.

Inventive Age, Washington, April 17, 1897.

This paper compares Zuñi and Chippewa looms with European forms.

—— The pointed canoe of the Kutenai River.

Science (New series) V, June 11, 1897, p. 927.

This canoe is compared with those of the Amoor, in Asia.

—— Primitive travel and transportation.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1894 (1897), pp. 257–593, pls. I–XXV, figs. 1–260.

This paper discusses going afoot, including the study of special costumes and appliances occasioned thereby; man as a carrier, and in drawing loads.

—— Influence of environment on human industries or arts.

Rep. Smithsonian Inst., 1895 (1897), pp. 639–665, pl. LXIX, figs. 1, 2.

This article forms one of a series on environments, and seeks to show how surrounding nature affects and conditions all human activities. Environmental or culture areas, 18 in number, are worked out for the western world.

MEARNS, EDGAR A. Preliminary diagnoses of new mammals from the Mexican border of the United States.

Proc. U. S. Nat. Mus., XIX, No. 1103, 1896, pp. 137–140.

An advance edition of this paper was issued May 25, 1896.

MEARNS, EDGAR A.—Continued.

—— Preliminary diagnoses of new mammals of the genera *Lynx*, *Urocyon*, *Spilogale* and *Mephitis*, from the Mexican boundary line.

Proc. U. S. Nat. Mus., XX, No. 1126, Jan. 12, 1897, pp. [1]–[4]. Advance edition.

—— Preliminary diagnoses of new mammals of the genera *Mephitis*, *Dorcelaphus*, and *Dicotyles*, from the Mexican border of the United States.

Proc. U. S. Nat. Mus., XX, No. 1129, Feb. 11, 1897, pp. [1]–[4]. Advance edition.

—— Preliminary diagnoses of new mammals of the genera *Sciurus*, *Castor*, *Neotoma* and *Sigmodon*, from the Mexican border of the United States.

Proc. U. S. Nat. Mus., XX, No. 1132, March 5, 1897, pp. [1]–[4]. Advance edition.

—— A new subgeneric name for the Water Hares (*Hydrolagus* Gray).

Science (New series), V, No. 114, March 5, 1897, p. 393.

MERRILL, GEORGE PERKINS. On the composition and structure of the Hamblen County, Tennessee, meteorite.

Am. Journ. Sci., XI, Aug., 1896, pp. 149–153.

—— Principles of rock-weathering (Studies for students).

Journ. Geol., IV, Nos. 6 & 7, Sept.–Nov., 1896, pp. 704–724, 850–871.

—— Weathering of micaceous gneiss in Albemarle County, Virginia.

Bull. Geol. Soc. Am., VIII, Feb. 22, 1897, pp. 157–168.

—— A Treatise | on | Rocks, Rock-weathering, and Soils. | By | George P. Merrill | Curator of Geology in the United States National Museum. | New York: | The Macmillan Co. | London: | Macmillan and Co., Ltd. | 1897. |

pp. I–XX, 1–411, pls. 1–25, figs. 1–42.

—— Stones | for | Building and Decoration. | Second Edition. | By | George P. Merrill, | Curator of Geology in the United States National Museum. | New York: | John Wiley & Sons, | 53 East Tenth Street. |

pp. I–IX, pp. 1–506, pls. I–XIX, figs. I–XVIII.

MURBACH, LOUIS. Observations on the development and migration of the urticating organs of sea nettles, Cnidaria.

Proc. U. S. Nat. Mus., XVIII, No. 1097, Oct. 7, 1896, pp. 733–740.

NELSON, E. W. Preliminary descriptions of new birds from Mexico and Guatemala in the collection of the United States Department of Agriculture.

Auk, XIV, No. 1, Jan., 1897, pp. 42–76.

Forty-two new species and subspecies and one new genus are described in the present paper, which is based mainly on collections made in Mexico and Guatemala by the author. The new forms are as follows: *Dendrortyx oaxacæ*, *D. macrourus griseipectus*, *D. macrourus striatus*, *Colinus salvini*, *C. godmani*, *C. insignis*, *C. graysoni nigripectus*, *Cyrtonyx merriami*, *Megascops marmoratus*, *Momotus mexicanus saturatus*, *Dryobates sanctorum*, *Antrostomus ridgwayi*, *Delattria pringlei*, *Platypsaris aglaiæ sumichrasti*, *Empidonax bairdi occidentalis*, *Picolaptes compressus insignis*, *Automolus pectoralis*, *Otocoris alpestris oaxacæ*, *Calocitta formosa azurea*, *Cissolopha pulchra*, *Agelaius phœniceus grandis*, *A. phœniceus richmondi*, *A. gubernator californicus*, *Ammodramus savannarum obscurus*, *Junco fulvescens*, *Peucæa ruficeps fusca*, *P. ruficeps australis*, *Cardinalis cardinalis littoralis*, *Chlorospingus atriceps*, *Phœnicothraupis rubicoides affinis*, *Dendroica goldmani*, *Basileuterus flavigaster*, *Heleodytes alticolus*, *H. occidentalis*, *H. humilis rufus*, *H. capistratus nigricaudatus*, *Salpinctes obsoletus neglectus*, *Hemiura pacifica*, *Henicorhina mexicana*, *H. leucophrys capitalis*, *Catharus occidentalis fulvescens*, *Merula tamaulipensis*.

The new genus *Hylorchilus* is created to receive the species formerly called *Catherpes sumichrasti*.

PILSBRY, HENRY A. Manual of conchology. Part 65.—Dentalium.

Man. Conch. Struct. & Syst., part 65, June, 1897, pp. 1–80, pl. 1–9.

Monograph of the family Dentaliidæ, based in part on collections of the U. S. National Museum.

POLLARD, CHARLES LOUIS. *Cassia proboscidea*.

Bull. Torrey Botan. Club, XXIII, July 20, 1896, pp. 281–282.

Describes a new *Cassia* from Barbados Island.

—— Notes on a trip to the Dismal Swamp.

Garden and Forest, IX, Nov. 18, 1896, p. 462.

Comments upon the most interesting plants observed on a trip to the Dismal Swamp.

—— The Acaulescent Violets.

Botan. Gaz., XXIII, Jan. 20, 1897, p. 53.

A reply to Prof. E. L. Greene's observations on this group.

—— Studies of the flora of the Central Gulf region. (I.)

Bull. Torrey Botan. Club, XXIV, March, 1897, pp. 148–158.

Discusses various plants of the Gulf region, establishing several new combinations of generic and specific names and describing *Cassia aspera mohrii*, n. var.

POLLARD, CHARLES LOUIS—Cont'd.

—— [Review of] Chapman's flora of the Southern United States.

Bull. Torrey Botan. Club, XXIV, April 24, 1897, pp. 210–213.

A review of the third edition of Chapman's work.

POWERS, WILLIAM L. Two new birds for Maine.

Auk, XIV, No. 2, April, 1897, p. 219.

Acanthis linaria rostrata and *A. linaria holbœllii* are recorded from Maine.

PRICE, WILLIAM W. Description of a new Pine Grosbeak from California.

Auk, XIV, No. 2, April, 1897, pp. 182–186.

A new form of the Pine Grosbeak, *Pinicola enucleator californica*, is described from the higher Sierra Nevada Mountains of California.

PURDY, JAMES B. Henslow's Bunting, *Ammodramus henslowi*, found breeding at Plymouth, Michigan.

Auk, XIV, No. 2, April, 1897, pp. 220–221.

Announcement of the nesting of Henslow's sparrow at Plymouth, Michigan.

OBERHOLSER, HARRY C. Critical remarks on the Mexican forms of the genus *Certhia*.

Auk, XIII, No. 4, Oct., 1896, pp. 314–318.

Two Mexican creepers are recognized, *Certhia familiaris albescens* (Berlepsch) and *C. familiaris alticola* Miller. These are treated in detail with full descriptions and synonymies.

—— Description of a new subspecies of *Dendroica*.

Auk, XIV, No. 1, Jan., 1897, pp. 76–79.

The name *Dendroica æstiva rubiginosa* (Pallas) is used to distinguish a form of yellow warbler inhabiting British Columbia and Alaska.

—— Critical remarks on *Cistothorus palustris* (Wils.) and its western allies.

Auk, XIV, No. 2, April, 1897, pp. 186–196.

Two western forms of *Cistothorus palustris* are recognized, of which *C. palustris plesius* is described as new. Full descriptions and synonymy of both forms are given.

RATHBUN, MARY J. The genus *Callinectes*.

Proc. U. S. Nat. Mus., XVIII, No. 1070, July 8, 1896, pp. 349–375, pls. XII–XXVIII.

A monograph of the genus, including a historical review, an analytical key, and descriptions and figures of the ten species, nine of which are in the National Museum. The name of the common edible species of eastern North America is changed from *Callinectes hastatus* to *C. sapidus*. A new subspecies is

RATHBUN, MARY J.—Continued.
described, and also a fossil specimen. In an appendix are given notes on the habits of *C. sapidus*, by the Hon. J. D. Mitchell, Judge Benjamin Harrison and Mr. Willard Nye, Jr.

—— Descriptions of two new species of fresh-water crabs from Costa Rica.

Proc. U. S. Nat. Mus., XVIII, No. 1071, July 8, 1896, pp. 377–379, pls. XXIX, XXX, figs. 1–3.

Descriptions of two new species of *Pseudothelphusa* from Costa Rica, received from the National Museum at San José, through Mr. J. Fid. Tristan.

—— Description of a new genus and four new species of crabs from the West Indies.

Proc. U. S. Nat. Mus., XIX, No. 1104, Dec. 21, 1896, pp. 141–144.

The crabs here described occur at the Florida Keys and Jamaica, and are represented in the collection of Mr. P. W. Jarvis of Kingston. The descriptions are preliminary to a "List of the Decapod Crustacea of Jamaica."

—— Descriptions de nouvelles espèces de Crabes d'eau douce appartenant aux collections du Muséum d'histoire naturelle de Paris.

Bull. Mus. d'Hist. Nat. Paris, III, No. 2, March, 1897, pp. 58–61.

Comprises descriptions of 4 species of *Pseudothelphusa* from Central and South America, published through the courtesy of Prof. E. L. Bouvier. Specimens of each species have been presented to the U. S. National Museum.

—— Synopsis of the American Sesarmæ with description of a new species.

Proc. Biol. Soc. Wash., XI, April 26, 1897, pp. 89–92.

In the synopsis, 4 subgenera and 18 species are recognized, and the synonymy is briefly given. Of the known species, 3 here receive new names, and one is described for the first time.

—— Synopsis of the American species of *Palicus* Philippi (= *Cymopolia* Roux), with descriptions of six new species.

Proc. Biol. Soc. Wash., XI, April 26, 1897, pp. 93–99.

Seventeen species of *Palicus* (of which six are new) have been dredged in American waters by the steamers *Bache*, *Blake*, and *Albatross*. A synopsis of all the species is given, together with descriptions of the new forms.

—— Synopsis of the American species of *Ethusa* with description of a new species.

Proc. Biol. Soc. Wash., XI, May 13, 1897, pp. 109–110.

A synopsis of the 5 American species of *Ethusa*, three of which occur on the Atlantic coast, and two on the Pacific. The new species described, *E. tenuipes*, inhabits the Gulf of Mexico and the Florida Keys.

—— Description of a new species of *Cancer* from Lower California, and additional note on *Sesarma*.

Proc. Biol. Soc. Wash., XI, May 13, 1897, pp. 111–112.

The new species of *Cancer*, *C. anthonyi*, was collected at Playa Maria Bay, west coast of Lower California, by Mr. A. W. Anthony.

Attention is called to *Sesarma æquatorialis* Ortmann, a species which should be added to those enumerated in a list published April 26, 1897.

—— The African Swimming Crabs of the genus *Callinectes*.

Proc. Biol. Soc. Wash., XI, June 9, 1897, pp. 149–151.

Four species of *Callinectes* are found on the coast of Africa. Of these, one species is new, one was formerly considered a subspecies, *C. tumidus gladiator*, and another, hitherto known as *C. larvatus* Ordway, is found to be synonymous with *Neptunus marginatus* A. Milne-Edwards, of earlier date. Incidentally the species *C. tumidus* Ordway, is changed to *C. exasperatus* (Gerstæcker).

—— A revision of the nomenclature of the Brachyura.

Proc. Biol. Soc. Wash., XI, June 9, 1897, pp. 153–167.

This revision is made in accordance with the code of the American Ornithologists' Union. The changes which it is found necessary to make are discussed under the following headings: (1) Names diverted from their original meaning; (2) The name of a composite genus tenable for one or more of its species which do not belong in older genera; (3) The name of a composite genus, when made up wholly of older genera, tenable for a component part requiring a name; (4) Specification of type; (5) Earlier names neglected; (6) Names based on figures without description; (7) Post-Linnæan name given by a polynomialist invalid; (8) Preoccupied names; (9) Names given simultaneously to different genera; (10) Original orthography to be preserved except in case of typographical error.

Twenty-six new generic names are proposed for old names which have been used in violation of accepted rules.

RICHARDSON, HARRIET. Description of a new crustacean of the genus *Sphæroma* from a warm spring in New Mexico.

Proc. U. S. Nat. Mus., XX, No. 1128, Feb. 6, 1897, p. [1.]. Advance edition.

This crustacean (*Sphæroma thermophilum*) was taken from a warm spring near Socorro, New Mexico, by Mr. T. D. A. Cockerell. It is

RICHARDSON, HARRIET—Continued.
contrasted with *S. dugesi* Dollfus, a Mexican species, and the only other *Sphæroma* inhabiting fresh water.

—— Description of a new species of *Sphæroma*.

Proc. Biol. Soc. Wash., XI, May 13, 1897, pp. 105–107, figs. 3–5.

The species here described (*Sphæroma destructor*) is a wood-borer, and was taken in large numbers from piers on St. John's River, Florida, at Palatka, where the water is fresh. One piece of wood was reduced by its ravages from 16 to 7½ inches in diameter in 8 years.

RICHMOND, CHARLES W. Catalogue of a collection of birds made by Doctor W. L. Abbott in Eastern Turkestan, the Thian-Shan Mountains, and Tagdumbash Pamir, Central Asia, with notes on some of the species.

Proc. U. S. Nat. Mus., XVIII, No. 1083, July 25, 1896, pp. 569–591.

A list of ninety-eight species, to which are added dates and localities of the specimens collected, and in many cases notes by the collector. *Ægialitis pamirensis*, *Passer montanus dilutus*, and *Merula merula intermedia* are described as new.

—— Description of a new species of Ant Thrush from Nicaragua.

Proc. U. S. Nat. Mus., XVIII, No. 1090, Aug. 12, 1896, pp. 625–626.

Phlegopsis saturata is described as new, although closely related to *P. macleannani*.

—— Partial list of birds collected at Alta Mira, Mexico, by Mr. Frank B. Armstrong.

Proc. U. S. Nat. Mus., XVIII, No. 1091, Aug. 12, 1896, pp. 627–632.

A list of sixty pieces obtained in Alta Mira, near Tampico, Mexico, of which several are of interest from the locality.

—— Descriptions of ten new species of birds discovered by Dr. W. L. Abbott in the Kilima-njaro region of East Africa.

Auk, XIV, No. 2, April, 1897, pp. 154–164.

The following species collected by Doctor Abbott are described as new: *Crithagra kilimensis*, *Crithagra striolata affinis*, *Estrilda cyanocephala*, *Cinnyris nectarinioides*, *Amydrus? dubius*, *Pholidauges femoralis*, *Laniarius abbotti*, *Prionops vinaceigularis*, *Chloropeta similis*, *Melanobucco abbotti*.

—— Catalogue of a collection of birds made by Doctor W. L. Abbott in Madagascar, with descriptions of three new species.

Proc. U. S. Nat. Mus., XIX, No. 1118, May 13, 1897, pp. 677–694.

A list of eighty-three species, to which are

RICHMOND, CHARLES W.—Continued.
added dates and localities, and in some cases critical notes.

Thalassornis insularis, *Ægialitis thoracica*, and *Copsychus inexspectatus* are described as new, and *Abbottornis* is proposed as a new name for *Leptopterus*, preoccupied.

RIDGWAY, ROBERT. *Melopelia leucoptera* in Osceola County, Florida.

Auk, XIV, No. 1, Jan., 1897, pp. 88–89.

Records a specimen of this dove from Osceola County, Florida.

—— Note on *Junco annectens* Baird and *J. ridgwayi* Mearns.

Auk, XIV, No. 1, Jan., 1897, p. 94.

The name *Junco annectens* is found to apply to the bird hitherto called *J. ridgwayi*, leaving the species formerly called *Junco annectens* without a name. To the latter is given the new name *Junco mearnsi*.

—— Correct nomenclature of the Texan Cardinal.

Auk, XIV, No. 1, Jan., 1897, p. 95.

A new name, *Pyrrhuloxia sinuata texana*, is applied to the Texan Cardinal, the true *P. sinuata* being ascertained to occur in Arizona and western Mexico. The name *P. sinuata beckhami*, erroneously bestowed on the latter, thus becomes a synonym.

—— *Dendroica cærulea* vs. *Dendroica rara*.

Auk, XIV, No. 1, Jan., 1897, p. 97.

Sylvia cærulea of Wilson is found to be antedated by *Sylvia cærulea* of Latham, necessitating the adoption of the subsequent *Sylvia rara* Wilson for the Cerulean Warbler, whose name thus becomes *Dendroica rara* (Wilson).

—— Birds of the Galapagos Archipelago.

Proc. U. S. Nat. Mus., XIX, No. 1116, March 15, 1897, pp. 459–670, pls. LVI, LVII, figs. 1–7.

A comprehensive review of the birds of the Galapagos Archipelago, giving a description of each of the 105 species known to occur on the islands, together with brief synonymy, and in many cases tables of measurements. Maps in the text illustrate the distribution of the species of each genus. The derivation of the Galapagos avifauna is discussed at some length, and tables showing the distribution of peculiar genera and those falling in other categories are added.

Two plates illustrate the variations in the form of the bill in the genera *Nesomimus*, *Camarhynchus* and *Geospiza*.

A bibliography of papers relating to Galapagoan ornithology completes the paper.

Melanospiza is a new generic term (p. 466, footnote).

ROBINSON, WIRT. An annotated list of birds observed on Margarita Island, and at Guanta and Laguayra, Venezuela.

Proc. U. S. Nat. Mus., XVIII, No. 1093, Aug. 12, 1896, pp. 649–685, pl. XXXIII, fig. 1.

ROBINSON, WIRT—Continued.

This paper includes descriptions of new species and critical notes by Charles W. Richmond. A list of seventy-three species observed on Margarita Island is given. Nine species are described as new, viz: *Butorides robinsoni, Eupsychortyx pallidus, Leptotila insularis, Scardafella ridgwayi, Speotyto brachyptera, Melanerpes subelegans neglectus, Dendroplex longirostris, Quiscalus insularis*, and *Hylophilus griseipes*.

A list of eighteen species observed at Guanta, and thirty-five species at Laguayra are added.

A good map of the island of Margarita accompanies the paper.

ROSE, JOSEPH NELSON. Plants from the Big Horn Mountains of Wyoming.

Contrib. U. S. Nat. Herbarium, III, No. 9, Aug. 5, 1896, pp. 567–574.

This is a catalogue of 96 species collected by Mr. Frank Tweedy in 1883. One new variety of willow is described by the late M. S. Bebb.

—— Preliminary revision of the North American species of *Chrysosplenium*.

Botan. Gaz., XXIII, No. 4, April, 1897, p. 275.

(See also under JOHN M. COULTER.)

ROSE, JOSEPH NELSON, and BAKER, E. G. *Robinsonella*, a new genus of Tree Mallows.

Garden and Forest, X, No. 487, June 23, 1897, pp. 244–245.

The genus is named for Dr. B. L. Robinson, curator of the Gray Herbarium, Cambridge, Mass.

ROSE, JOSEPH NELSON, and HEMSLEY, W. BOTTING. *Tradescantia orchidophylla*.

Hooker's Icon. Plant., VI, pt. 1, ser. 4, Feb., 1897, pl. 2552.

SATOH, H. The wooden statue of Baron Ii Kamon-no-Kami Naosuké, pioneer diplomat of Japan. (Translation of label accompanying the statue.)

Rep. Smithsonian Inst. (U. S. Nat. Mus.) 1894 (1897), pp. 619–622, pl. I.

SCHUCHERT, CHARLES. What is a type in natural history?

Science (New series), V, No. 121, April 23, 1897, pp. 636–640.

Defines the kinds of type specimens and proposes the new terms, hypotype, holotype, plastotype, hypoplastotype and genotype.

—— On the fossil phyllopod genera, *Dipeltis* and *Protocaris*, of the family Apodidæ.

Proc. U. S. Nat. Mus., XIX, No. 1117, May 13, 1897, pp. 671–676, pl. LVIII.

Discusses the Paleozoic representatives *Dipeltis* and *Protocaris* of the family Apodidæ, and defines the species *D. diplodiscus* Packard, and *D. carri* n. sp. The family is subdivided into the Apodinæ and Dipeltinæ, both new subfamilies.

—— Report on Paleozoic fossils from Alaska.

17th Ann. Rep. U. S. Geol. Surv. 1895–96 (1897), pp. 898–906.

This paper gives a summary of the known Paleozoic fossils of Alaska, and describes a number of species new to that region.

SCHWARZ, E. A. [New genus and species of Psyllid from Japan.]

Proc. U. S. Nat. Mus., XIX, No. 1108, Dec. 30, 1896, pp. 295–297.

These descriptions are included in a paper by Philip R. Uhler entitled "Summary of the Hemiptera of Japan presented to the United States National Museum by Professor Mitsukuri." *Anomoneura mori* is described as a new genus and species.

SCUDDER, SAMUEL H. The species of the genus *Melanoplus*.

Proc. Am. Philosoph. Soc., XXXVI, Jan., 1897, pp. 5–35.

This paper is based upon a memoir to be published shortly by the U. S. National Museum. It contains tables of the species and a considerable number of the latter are diagnosed, but are not indicated in the tables. The original memoir is based largely upon Museum material, and a majority of the types of the new species are in the Museum collection.

SIMPSON, CHARLES TORREY. The muscle scars of Unios.

Nautilus, X, July, 1896, pp. 29–30.

It is shown that the great variability of muscular scars in Unionidæ prevents their use as a character for classification.

—— Notes on the Parvus group of Unionidæ and allies.

Nautilus, X, Sept., 1896, pp. 57–59.

Review of a paper by R. Ellsworth Call on this group, published in the Proceedings of the Indiana Academy of Science for 1895.

—— [Review of the Unionidæ of the Mexican Boundary region, with a description of *Unio mitchelli* from Texas.]

Proc. U. S. Nat. Mus., XIX, No. 1111, Jan. 27, 1897, pp. 370–374, pl. XXXII, figs. 1–5.

This article is included in Mr. Dall's report on the mollusks collected by the International Boundary Commission of the United States and Mexico, 1892–1894.

—— The Janthinas.

Nautilus, V, April, 1897, pp. 133–134.

Notes on an enormous shoal of Janthinas washed ashore on Key West Island, Florida.

SIMPSON, CHARLES TORREY—Cont'd.
—— *Helicina dysoni.*
Nautilus, XI, June, 1897, pp. 13-14.
An account of collecting this mollusk on the Brickley Thatch Palms of Utilla, Honduras.

—— Notes on the classification of Unios.
Nautilus. XI, June, 1897, pp. 18-23.
Anatomical and conchological notes on the genus *Unio* and their bearing on the classification. In this paper it is proposed to divide the old genus *Unio* into other genera founded on characters of the shell and soft parts.

SMITH, HUGH M.
(See under BARTON W. EVERMANN.)

STANTON, TIMOTHY W. On the genus *Remondia* Gabb, a group of Cretaceous bivalve mollusks.
Proc. U. S. Nat. Mus., XIX, No. 1109, Dec. 30, 1896, pp. 299-302, pl. XXVI.
Discusses the genus *Remondia* and defines it.

—— [Cretaceous section near the mouth of Judith River, Montana.]
Monogr. U. S. Geol. Surv., XXVII, 1896, pp. 239-241.
A descriptive note contained in the "Geology of the Denver Basin," by Messrs. Emmons, Cross and Eldridge.

—— [Upper Cretaceous section of Price River Canyon, near Castle Gate, Utah.]
Monogr. U. S. Geol. Surv., XXVII, 1896, pp. 241-242.
This note forms a part of the work entitled "Geology of the Denver Basin," by Messrs. Emmons, Cross and Eldridge, published in the volume mentioned.

—— The faunal relations of the Eocene and Upper Cretaceous on the Pacific Coast.
17th Ann. Rep. U. S. Geol. Surv., 1895-96 (1897) pp. 1005-1059, pls. LXIII-LXVII.
Discusses the local development and stratigraphy of the Chico and Tejon formations. The Martinez group is shown to be not a simple formation and a subdivision of the Chico, but to contain two distinct faunas, "one of which is Cretaceous and inseparable from the Chico, while the other is Eocene, and is here classed as Lower Tejon." Sixteen species reported to occur in both the Chico and Tejon formations are discussed. Twenty-three Lower Tejon species are described, of which ten are new.

STANTON, TIMOTHY W., and KNOWLTON, FRANK HALL. Stratigraphy and Paleontology of the Laramie and related formations in Wyoming.
Bull. Geol. Soc. Am., VIII, 1897, pp. 127-156.
Partly based on material belonging to the National Museum.

STEARNS, ROBERT E. C. *Purpura lapillus* Linne; an imbricated variety collected at Boston, Mass.
Nautilus, X, No. 8, Dec., 1896, p. 85.

—— *Uvanilla regina*, a new locality.
Nautilus, XI, No. 1, May, 1897, p. 1.
Originally described from Guadalupe Island, coast of Lower California; subsequently detected on San Clemente Island, California.

—— Description of a new species of *Actæon* from the Quaternary bluffs of Spanish Bight, San Diego, California.
Nautilus, XI, No. 2, 1897, pp. 14-15.
Describes *Actæon traskii* Stearns as new. The types are in the U. S. National Museum. The shell is also recent at San Diego.

STEJNEGER, LEONHARD. Description of a new genus and species of blind tailed batrachians from the subterranean waters of Texas.
Proc. U. S. Nat. Mus., XVIII, No. 1088, 1896, pp. 619-621.
An advance edition of this paper was issued April 15, 1896.

—— Description of a new species of Guillemot from the Kuril Islands.
Auk, XIV, No. 2, April, 1897, pp. 200-201.
Cepphus snowi is described as new.

STILES, CHARLES WARDELL. Report upon the present knowledge of the tapeworms of poultry.
Bull. Bureau Animal Industry, U. S. Dept. Agric., No. 12, 1896, pp. 1-79, pls. I-XXI.

—— A revision of the adult tapeworms of hares and rabbits.
Proc. U. S. Nat. Mus., XIX, No. 1105, Dec. 30, 1896, pp. 145-235, pls. V-XXV.

STILES, CHARLES WARDELL, and HASSALL, ALBERT. Notes on Parasites—47. On the priority of *Cittotænia* Riehm, 1881, over *Ctenotænia* Railliet, 1897.
Veterinary Magazine, III, No. 7, July, 1896, p. 407.

STONE, WITMER. The genus *Sturnella.*
Proc. Acad. Nat. Sci. Phila., 1897, pp. 146-152.
A revision of the forms of *Sturnella*, mainly directed to the birds inhabiting the United States.
Sturnella magna hoopesi from Brownsville, Texas, is described as new.

TANNER, Z. L. Deep-sea exploration: a general description of the steamer *Albatross*, her appliances and methods.
Bull. U. S. Fish Com., 1896, Art. 5, June, 1897, pp. 257-428, pls. I-XL.
The chapter on the preparation and preservation of specimens was compiled largely from

TANNER, Z. L.—Continued.
data furnished by Mr. James E. Benedict, assistant curator of the department of marine invertebrates, U. S. National Museum.

TOWNSEND, CHARLES H. Description of a new eagle from Alaska and a new squirrel from Lower California.
Proc. Biol. Soc. Wash., XI, June 9, 1897, pp. 145-146.
A new subspecies of Bald Eagle, *Haliætus leucocephalus alascanus*, is described from Unalaska, Alaska.

TRUE, FREDERICK W. Note on the occurrence of an armadillo of the genus *Xenurus* in Honduras.
Proc. U. S. Nat. Mus., XVIII, No. 1069, July 8, 1896, pp. 345-347, pls. X, XI.
Notes the occurrence of *Xenurus hispidus* Burm., in Honduras, and describes the skin and skull in detail; also points out the probable identity with this species of *X. latirostris* and *Ziphila lugubris*. Figures of the mounted skin and skull accompany the article.

—— A revision of the American moles.
Proc. U. S. Nat. Mus., XIX, No. 1101, Dec. 21, 1896, pp. 1-112, pls. I-IV, figs. 1-44.
This monograph deals with the family Talpidæ, and the characters and geographical distribution of the several American forms are discussed in detail.
A new species, *Scapanus orarius* True, is described.

UHLER, PHILIP R. Summary of the Hemiptera of Japan, presented to the United States National Museum by Professor Mitsukuri.
Proc. U. S. Nat. Mus., XIX, No. 1108, Dec. 30, 1896, pp. 255-297.
Reports on one hundred and thirty-two species of Hemiptera (Heteroptera and Homoptera) from Japan, presented by Professor Mitsukuri. Five new genera and forty-six new species are described.

WALCOTT, CHARLES DOOLITTLE. Fossil Jelly fishes from the Middle Cambrian terrane.
Proc. U. S. Nat. Mus., XVIII, No. 1086, Aug. 12, 1896, pp. 611-614, pls. XXXI, XXXII.
The new genera *Brooksella* and *Laotira* are defined, in addition to the new species *B. alternata*, *B. confusa* and *L. cambria*.

—— Note on the genus *Lingulepis*.
Am. Journ. Sci., III, 1897, pp. 404-405.

WHITE, DAVID. Age of the Lower coals of Henry County, Missouri.
Bull. Geol. Soc. Am., VIII, 1897, pp. 287-304.
Concludes that the Lower Coals of Henry county, Missouri, in geological age are "probably not very far from the Lower Kittaning coal of the bituminous sections and very near to coal D of the Northern Anthracite region."

WILSON, THOMAS. Piney Branch (D. C.) quarry workshop and its implements.
Naturalist, XXX, No. 359, Nov., 1896, pp. 873-885, pls. XIX, XX, figs. 1-5; No. 360. Dec., 1896, pp. 976-992, pls. XXIII-XXVII.

—— Antiquity of the Red Man.
Popular Science News, XXXI, No. 2, Feb., 1897, pp. 35-36; No. 3, March, 1897, p. 60.

—— Classification of arrow and spearheads or knives.
Antiquarian, I, pt. 6, June, 1897, pp. 145-151, figs. 1-23.
These weapons or implements are divided into the following classes: (I) Leaf-shaped implements, (II) Triangular implements, (III) Stemmed, shouldered and barbed implements, (IV) Peculiar forms.

—— The Swastika, the earliest known symbol, and its migrations; with observations on the migrations of certain industries in prehistoric times.
Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1894 (1897), pp. 757-1011, pls. 1-25, figs. 1-374.
The use, if not the origin, of the Swastika sign can be traced to prehistoric times, especially in the Bronze Age in Asia and throughout Europe. It is not found in Babylon, Assyria, Chaldea or Egypt. It appeared in prehistoric times among North American savages and in Central and South America, and is continued in the eastern regions of the Orient in modern times. It is used among the Buddhists as a holy sign, but is believed to have been generally a sign of good luck, happiness, long life. The question of its migration is argued, and signs and industries of the different countries are compared.

—— Golden Patera of Rennes.
Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1894 (1897), pp. 609-617, plate and figure.
Describes the find at Rennes of this Roman relic belonging to the fourth or fifth century, A. D. The paper is based upon a cast in the National Museum.

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APPENDIX V.

Papers Published in Separate Form During the Year Ending June 30, 1897.

FROM THE REPORT FOR 1894.

Report upon the condition and progress of the U. S. National Museum during the year ending June 30, 1894. By G. Brown Goode. pp. 1–233.

Primitive travel and transportation. By Otis Tufton Mason. pp. 237–593, pls. 1–25, figs. 1–260.

Mancala: The national game of Africa. By Stewart Culin. pp. 595–607, pls. 1–5, figs. 1–15.

The golden patera of Rennes. By Thomas Wilson. pp. 609–617, pl. 1, fig. 1.

The wooden statue of Baron Ii Kamon-no-Kami Naosuké, pioneer diplomat of Japan. Translation, by H. Satoh, of the label accompanying the statue. pp. 619–622, pl. 1.

A study of the primitive methods of drilling. By J. D. McGuire. pp. 623–756, figs. 1–201.

The Swastika. By Thomas Wilson. pp. 757–1011, pls. 1–25, figs. 1–374.

FROM VOLUME 18, PROCEEDINGS OF THE U. S. NATIONAL MUSEUM.

No. 1069. Note on the occurrence of an armadillo of the genus *Xenurus* in Honduras. By Frederick W. True. pp. 345–347, pls. x, xi.

No. 1070. The genus *Callinectes*. By Mary J. Rathbun. pp. 349–375, pls. xii–xxviii.

No. 1071. Descriptions of two new species of fresh water crabs from Costa Rica. By Mary J. Rathbun. pp. 377–379, pls. xxix, xxx, figs. 1–3.

No. 1083. Catalogue of a collection of birds made by Dr. W. L. Abbott in Eastern Turkestan, the Thian-Shan Mountains, and Tagdumbash Pamir, Central Asia, with notes on some of the species. By Charles W. Richmond. pp. 569–591.

No. 1084. Descriptions of three species of sand fleas (Amphipods) collected at Newport, Rhode Island. By Sylvester D. Judd. pp. 593–603, figs. 1–11.

No. 1085. Remarks on the synonymy of some North American Scolytid Beetles. By William Eichhoff. pp. 605–610.

No. 1086. Fossil Jelly Fishes from the Middle Cambrian terrane. By Charles D. Walcott. pp. 611–614, pls. xxxi, xxxii.

No. 1087. Preliminary descriptions of a new genus and three new species of crustaceans from an artesian well at San Marcos, Texas. By James E. Benedict. pp. 615–617.

No. 1088. Description of a new genus and species of blind tailed batrachian from the subterranean waters of Texas. By Leonhard Stejneger. pp. 619–621.

No. 1089. Description of a new Stickleback, *Gasterosteus gladiunculus*, from the coast of Maine. By W. C. Kendall. pp. 623–624.

No. 1090. Description of a new species of Ant Thrush from Nicaragua. By Charles W. Richmond. pp. 625–626.

No. 1091. Partial list of birds collected at Alta Mira, Mexico, by Mr. Frank B. Armstrong. By Charles W. Richmond. pp. 627–632.

No. 1092. On some reared parasitic Hymenopterous insects from Ceylon. By L. O. Howard and William H. Ashmead. pp. 633-648.

No. 1093. An annotated list of birds observed on the Island of Margarita and at Guanta and Laguayra, Venezuela. By Lieut. Wirt Robinson, U. S. A. [With critical notes and descriptions of new species by Charles W. Richmond.] pp. 649-685, pl. XXXIII.

No. 1094. List of Coleoptera collected on the Tana River, and on the Jombéné Range, East Africa, by Mr. William Astor Chanler and Lieutenant Ludwig von Höhnel, with descriptions of new genera and species. By Martin L. Linell. pp. 687-716.

No. 1095. Contributions to the natural history of the Commander Islands. XI.—The cranium of Pallas's Cormorant. By Frederic A. Lucas. pp. 717-719, pls. XXXIV, XXXV.

No. 1096. New species of North American Coleoptera of the family Scarabæidæ. By Martin L. Linell. pp. 721-731.

No. 1097. Observations on the development and migration of the urticating organs of Sea Nettles, Cnidaria. By Louis Murbach. pp. 733-740.

No. 1098. List of the Lepidoptera collected in East Africa, 1894, by Mr. William Astor Chanler and Lieutenant Ludwig von Höhnel. By W. J. Holland. pp. 741-767.

No. 1099. Notes on the Vampire Bat (*Diphylla ecaudata*), with special reference to its relationships with *Desmodus rufus*. By Harrison Allen. pp. 769-777, figs. 1-6.

No. 1100. Description of a new species of Bat of the genus *Glossophaga*. By Harrison Allen. pp. 779-781.

FROM VOLUME 19, PROCEEDINGS OF THE U. S. NATIONAL MUSEUM.

No. 1101. A revision of the American moles. By Frederick W. True. pp. 1-112, pls. I-IV, figs. 1-44.

No. 1102. Descriptions of new cynipidous galls and gall-wasps in the United States National Museum. By William H. Ashmead. pp. 113-136.

No. 1103. Preliminary diagnoses of new mammals from the Mexican border of the United States. By Edgar A. Mearns, U. S. A. pp. 137-140.

No. 1104. Description of a new genus and four new species of crabs from the West Indies. By Mary J. Rathbun. pp. 141-144.

No. 1105. A revision of the adult tapeworms of hares and rabbits. By Charles Wardell Stiles. pp. 145-235, pls. V-XXV.

No. 1106. Contributions to the natural history of the Commander Islands. XII—Fishes collected at Bering and Copper Islands by N. A. Grebnitski and Leonhard Stejneger. By Tarleton H. Bean and Barton A. Bean. pp. 237-251.

No. 1107. Is the Florida Box Tortoise a distinct species? By Einar Lönnberg. pp. 253-254.

No. 1108. Summary of the Hemiptera of Japan, presented to the United States National Museum by Professor Mitsukuri. By Philip R. Uhler. pp. 255-297.

No. 1109. On the genus *Remondia* Gabb, a group of Cretaceous bivalve mollusks. By Timothy W. Stanton. pp. 299-301, pl. XXVI.

No. 1110. Descriptions of Tertiary fossils from the Antillean Region. By R. J. Lechmere Guppy, and William Healey Dall. pp. 303-331, pls. XXVII-XXX.

No 1111. Report on the mollusks collected by the International Boundary Commission of the United States and Mexico, 1892-1894. By William Healey Dall. pp. 333-379, pls. XXXI-XXXIII.

No. 1112. Notes on fishes collected in Kamchatka and Japan by Leonhard Stejneger and N. A. Grebnitski, with a description of a new Blenny. By Tarleton H. Bean and Barton A. Bean. pp. 381-392, pls. XXXIV, XXXV.

No. 1113. Descriptions of new species of North American Coleoptera in the families Cerambycidæ and Scarabæidæ. By Martin L. Linell. pp. 393–401.

No. 1114. Report on the fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species. By Charles Henry Gilbert, and Frank Cramer. pp. 403–435, pls. XXXVI–XLVIII.

No. 1115. Descriptions of twenty-two new species of fishes collected by the steamer *Albatross*, of the United States Fish Commission. By Charles Henry Gilbert. pp. 437–457, pls. XLIX–LV, figs. 1–7.

No. 1116. Birds of the Galapagos Archipelago. By Robert Ridgway. pp. 459–670, pls. LVI, LVII.

No. 1117. On the fossil Phyllopod genera, *Dipeltis* and *Protocaris*, of the family Apodidæ. By Charles Schuchert. pp. 671–676, pl. LVIII.

No. 1118. Catalogue of a collection of birds made by Doctor W. L. Abbott in Madagascar, with descriptions of three new species. By Charles W. Richmond. pp. 677–694.

No. 1119. On the insects collected by Doctor Abbott on the Seychelles, Aldabra, Gloriosa, and Providence Islands, with descriptions of nine new species of Coleoptera. By Martin L. Linell. pp. 695–706.

FROM VOLUME 20, PROCEEDINGS OF THE U. S. NATIONAL MUSEUM.

No. 1126. Preliminary diagnoses of new mammals of the genera *Lynx*, *Urocyon*, *Spilogale*, and *Mephitis*, from the Mexican boundary line. By Dr. Edgar A. Mearns, U. S. A. pp. [1]–[4]. (Advance edition.)

No. 1127. Description of a new Blenny-like fish of the genus *Opisthocentrus*, collected in Vulcano Bay, Port Morusan, Japan, by N. A. Grebnitski. By Tarleton H. Bean and Barton A. Bean. p. [1]. (Advance edition.)

No. 1128. Description of a new crustacean of the genus *Sphæroma* from a warm spring in New Mexico. By Harriet Richardson. p. [1]. (Advance edition.)

No. 1129. Preliminary diagnoses of new mammals of the genera *Mephitis*, *Dorcelaphus*, and *Dicotyles*, from the Mexican border of the United States. By Dr. Edgar A. Mearns, U. S. A. pp. [1]–[4]. (Advance edition.)

No. 1132. Preliminary diagnoses of new mammals of the genera *Sciurus*, *Castor*, *Neotoma*, and *Sigmodon*, from the Mexican border of the United States. By Dr. Edgar A. Mearns, U. S. A. pp. [1]–[4]. (Advance edition.)

APPENDIX VI.

Specimens Sent to the Museum for Examination and Report.[1]

The following is a list of the specimens received for examination and report, arranged alphabetically by the names of the senders, during the year ending June 30, 1897:

Academy of Natural Sciences, Philadelphia, Pennsylvania, through Witmer Stone: Two specimens of Horned Owl. (Returned.) 4094 (II).

Aiken, C. E., Colorado Springs, Colorado: Bird-skin. 4352 (31946) (II).

Aldrich, Charles, Des Moines, Iowa: Archæological object, transmitted in behalf of D. T. Stanley. 4243 (32157) (XIV).

Aldrich, Hon. Truman H., House of Representatives: Shells; Unios. (Returned.) 3952, 4192 (VI).

Allen, Hon. C. E. (See under Rankin, A. W.)

Allen, Dr. J. A. (See under American Museum of Natural History.)

Allen, Richard S., Vinitaville, Virginia: Bird-skin. 3897 (II).

American Museum of Natural History, New York City. Transmitted by Dr. J. A. Allen: Birds' skins. (Returned.) 4320, 4383 (II).

Anderson, R. M., Iowa City, Iowa: Four sparrows; four birds' skins, consisting of *Ammodramus lecontei; Dendroica blackburniae*, and *Dendroica pensylvanica*. (Returned.) 3799, 4082 (II).

Andall, J. A., Marble Falls, Texas: Ore. (Returned.) 3994 (XIII).

Anthony, A. W., San Diego, California: Birds' skins from Lower California. (Returned.) 4039, 4066 (II).

Applegate, Elmer I., Klamath Falls, Oregon: Eight dried plants. 3953 (31331) (XI).

Archibald, J. F. J., San Francisco, California: Wax impressions of a scarabeus. 4437 (XVI).

Arnesen, Bernt, Big Woods, Minnesota, transmitted by Hon. Knute Nelson: Mineral. 4324 (XII).

Arnheim, J. S., San Francisco, California: Land-shells from the Central Pacific. 4270 (portion returned and remainder retained, 31884) (VI).

Arnold, Delos, Pasadena, California: Rock. (Returned.) 4397 (XIII).

Arnold, J. J., Pawling, New York: Sample of supposed petroleum. (Returned.) 4058 (XIII).

Ashmun, Rev. E. H., Albuquerque, New Mexico: Land, fresh-water, and marine shells. (Returned.) 3851, 3979, 4055, 4454 (VI).

Attwater, H. P., San Antonio, Texas: Eleven birds' skins. 3911 (31114) (II).

Auringer, Rev. O. C., Troy, New York: Small leaf-shaped implement 4411; archæological objects (returned), 4441 (XIV).

Bache, Edward, Fort Brown, Texas: Insect. (Returned.) 3963 (VII).

Bacon, Thomas H., Hannibal, Missouri: Clay head. (Returned.) 3895 (XIV).

Baker, F. C. (See under Chicago Academy of Sciences.)

Badger Creek Mines and Land Company, Cripple Creek, Colorado: Rock. (Returned.) 4333 (XIII).

[1] The first number accompanying the entries in the above list is that assigned to sendings "for examination" on the Museum records. The number in Roman, in parentheses, indicates the department in the Museum to which the material was referred for examination and report. The numbers assigned to these departments have been changed since the last report was published. When material is permanently retained, a number of another series, i. e., the permanent accession record-number, is placed in parentheses between the two sets of numbers referred to.

Bailey, G. W., Nevada, Iowa: Skull of an Apache Indian, and an Indian pot from a mound in Marshall County. 4028 (xiv).

Bailey, T. P., Springfield, Missouri: Rock; ore. (Returned.) 3781, 3815 (xii, xiii).

Baker, Frank C., Chicago Academy of Sciences, Chicago, Illinois: Unios. (Returned.) 4103 (vi). (See under Chicago Academy of Sciences.)

Baker University, Baldwin, Kansas, transmitted by C. S. Parmenter: Insects. 4002 (vii).

Banner, W. H., York, Pennsylvania: Two historical war pictures. 4429 (32161) (xvii).

Barbour, E. H., University of Nebraska, Lincoln, Nebraska: Fossil. (Returned.) 4142 (x–b).

Bardu, N. J., Llano, Texas: Mineral. (Returned.) 3924 (xii).

Barlow, Chester, Santa Clara, California: Two birds' skins. (Returned.) 4424 (ii).

Barnes, F. P., Baldwinsville, New York: Piece of a bone supposed to have been used for drilling the so-called bannerstone. (Returned.) 3857 (xiv).

Bash, Mrs. C. B., Camp McKinney, British Columbia: Plants. 4443 (xi).

Basinger, Jacob W., Columbus Grove, Ohio: Ore. (Returned.) 4123 (xiii).

Batchelder, C. F., Boston, Massachusetts: Three birds' skins. (Returned.) 4328 (ii).

Baxter, R. T., Fishkill, New York: Fungus. 3879 (xi).

Beach, William, Superior, Montana: Ore. (Returned.) 4250 (xiii).

Bearden, C. C., Jacksonville, Texas: Grass. (Returned.) 4376 (xi).

Beck, R. H., Berryessa, California: Thirty-five birds' skins. (Returned.) 4449 (ii).

Beckner, W. L., Blue River, Oregon: Mineral. (Returned.) 4218 (xii).

Beer, William, New Orleans, Louisiana: Wooden carving representing a human head. (Returned.) 4077 (xiv).

Bemis, Henry A., Cooperstown, North Dakota: Portion of a water-sack containing parasites. 4195 (viii–a).

Bendire, Maj. Charles. (See under Judson, W. B.)

Bensinger, J. G., Wadsworth, Illinois: Ore. (Returned.) 3978 (xiii).

Benson, S. W., Kelseyville, California: Supposed meteoric stone. 4132 (31551) (xii).

Betts, William C., Essex Fells, New Jersey: Stone club or pestle. (Returned.) 4476 (xiv).

Beyer, G., New York City: Coleoptera. (Returned.) 4248 (vii).

Biederman, C. R., Central Point, Oregon, and also McMillan, New Mexico: Rock; sample of white metal. (Returned.) 3998, 4211 (xiii).

Binner, Oscar E., Chicago, Illinois: Original water-color drawings of fruits of India. (Returned.) 3948 (xi).

Bishop, Dr. L. B., New Haven, Connecticut: Birds' skins and birds' eggs. (Returned.) 4366, 4445, 4446 (ii).

Blackford, Dr. C. M., jr., Atlanta, Georgia: Clay. (Returned.) 4490 (xii).

Blair, E. S., Helena, Montana: Tooth of a mammal. (Returned.) 3844 (i).

Bloomis, O. B., Harrisburg, Arizona: Ore. (Returned.) 4401 (xiii).

Bolen, G. R., Madison, Indiana: Aerolite. (Returned.) 4130 (xii).

Boscoe, J. F., Hembrie, Texas: Flower and leaf of a plant. 3811 (xi).

Bouldin, Powhatan, Danville, Virginia: Fairy-stones. (Returned.) 4101 (xii).

Bowles, Rev. A. C., Gloucester, Massachusetts: Branch of a tree. 3855 (xi).

Bowling, R. T., Navajoe, Oklahoma. Ore. (Returned.) 4134 (xiii).

Boyd, C. R., Wytheville, Virginia: Supposed manganese crystal. 3847 (xiii).

Bracken, A. H., Hensley, North Carolina: Ores. (Returned.) 3876, 3918 (xiii).

Braendle, Fred. J., Washington, District of Columbia: Plant. 3950 (xi).

Braithwaite, Eliza C., Jacksondale, Virginia: Insect. (Returned.) 3873 (vii).

Breathwit, J. L., Ogemaw, Arkansas: Clay. (Returned.) 4139 (xiii).

Breninger, G. F., Enterprise, California: Two birds' skins; bird-skin. 4023 (returned); 4102 (31463) (ii).

Brewster, William, Cambridge, Massachusetts: Birds' skins. (Returned.) 4180, 4294, 4322, 4408 (ii).

BRIDWELL, ARTHUR, Baldwin, Kansas: Upper Carboniferous fossils. (Returned.) 3909 (X–B).

BRIDGES, Dr. T. M., Fort Hall Indian Agency, Blackfoot, Idaho: Worm. 3786 (VIII–A).

BRIGGS, A. A., Clear Lake, Wisconsin: Plants. 3904 (31141); 3967; 3973 (31332) (XI).

BRIGHTMAN, S. A., Sullivan, Kentucky: Minerals. (Returned.) 4161, 4291 (XII).

BRIMLEY, H. H. and C. S., Raleigh, North Carolina: Birds' skins; turtles and snake; snake; snakes; lizard. 3780, 3791 (returned); 4138 (31546); 4351, 4362, 4400 (returned). (II, IV.)

BRITISH MUSEUM, London, England: Transmitted by Osbert Salvin. Six owls. 4374 (II).

BRITTON, Dr. N. L., Columbia College, New York City: Herbarium specimens. (Returned.) 3848 (XI).

BRODNAX, Dr. B. H., Brodnax, Louisiana: Fungi; wood covered with fungus. 3845; 3915 (31149); 3997 (XI).

BROMLEY, Mrs., Washington, District of Columbia: Ore. (Returned.) 4004 (XII).

BROOKE, Mrs. J. M., Fredericksburg, Virginia: Unio. (Returned.) 4075 (VI).

BROUILLETTE, BERNARD, Vincennes, Indiana: Stone. (Returned.) 4340 (XII).

BROWN, HERBERT, Tucson, Arizona: Insect. (Returned.) 3833 (VII).

BROWN, M. J., Mineral Wells, Texas: Copper coin. (Returned.) 4197 (XVII).

BROWN, W. F., Joseph, Utah: Ore. 3812 (XIII).

BROWN, Dr. WALTER, Hamilton, Ohio: Worms. 4020 (VIII–A).

BRYANT, W. H., Bryantsville, Indiana: Mineral; ore. (Returned.) 4062, 4164 (XII, XIII).

BUCHWALD, P. R., Vienna, Virginia: Ore. (Returned.) 4411 (XIII).

BUCKLEY, J. A., Deckertown, New Jersey: Ore. (Returned.) 4220 (XIII).

BUFFAT, E. F., Knoxville, Tennessee: Ore. (Returned.) 4017 (XIII).

BURKS, W. S., Pittsburg, Texas: Rock. (Returned.) 4179 (XIII).

BURLINGAME, G. W., Chepachet, Rhode Island: Mosses. (Returned.) 4143 (XI).

BURR, E. E., Northport, Washington: Ore. 4140 (XIII).

BURTCH, VERDI, Penn Yan, New York: Fresh-water shells; Unionidæ. 4408 (portion returned and remainder retained, 31242); 4078 (returned); 4163 (portion returned and remainder retained, 31574); 4209 (portion returned and remainder retained, 31669). (VI.)

BUSH, B. F., Courtney, Missouri: Land and fresh-water shells. 4088 (portion returned and remainder retained, 31429); 4177 (returned). (VI.)

BUTLER, J. D., Trout, West Virginia: Mineral. (Returned.) 4215 (XII).

BUTLER, Hon. MARIAN. (See under Metcalf, W. W.)

BUZZARD, S. S., Berkeley Springs, West Virginia: Specimen of maple wood. 4118 (XVII).

BUZZERD, A. C., Virginia City, Montana: Ore. (Returned.) 4462 (XIII).

CALIFORNIA ACADEMY OF SCIENCES, San Francisco, California, transmitted by L. M. Loomis: Birds' skins. Transmitted by Dr. J. G. Cooper, land, fresh-water, and marine shells. 3938 (returned); 4087 (portion returned and remainder retained in exchange, 31198); 4370 (portion returned and remainder retained, 32032). (II, VI.)

CALKINS RAYMON, Milford, Michigan: Piece of supposed petrified wood; stone relics. (Returned.) 3901 (X–B, XIV).

CARBOLINEUM WOOD-PRESERVING COMPANY, New York City: Piece of wood from Palatka, Florida, eaten by an insect. (Returned.) 3801 (VIII).

CAREY, N. H., Providence, Rhode Island: Land and marine shells. (Returned.) 3984; 3988 (VI.)

CARMAN, A. J., Ocala, Florida: Plants. (Returned.) 3956 (XI).

CARR, T. F., Ezel, Kentucky: Ores. (Returned.) 4237; 4331 (XIII, XII).

CASE, A. R., West Simsbury, Connecticut: Chrysalis of a butterfly. (Returned.) 3936 (VII).

CATON, G. T., Sutton, Tennessee: Rocks. (Returned.) 3881 (XIII).

CHAMPION, W. R., Hazel Green, Wisconsin: Galena from Wisconsin and Illinois; archæological object. 4451 (32273); 4299 (returned). (XIII, XIV.)

CHASE, Dr. A. G., Millwood, Kansas: Skin of supposed petrified shark; Indian arrow-head. 3880 (V, XIV).

CHICAGO ACADEMY OF SCIENCES, Chicago, Illinois, transmitted by Frank C. Baker: Shells. 3829 (portion returned and remainder retained, 30929); 4316 (portion returned and remainder retained, 31956). (VI.)

CHRISTIAN, ISAAC E., Oceana, West Virginia: Iron nail found embedded in a piece of coal, and a piece of the coal. 4337 (iron nail returned) (XIII).

CHRISTOFFERSEN, MILLARD, Teardale, Utah: Stone. (Returned.) 3885 (XIII).

CHRISTY, THOMAS, & Co., London, England: Bark and seeds from California and other sections of the United States. 3993 (XVII).

CLARK, F. H., Salt Lake City, Utah: Supposed coal. (Returned.) 4371 (XIII).

CLEVELAND, W. H., Manomet, Massachusetts: Egg cases of *Fulgur*. (Returned.) 4187 (VI).

COLE, J. L., Manomet, Massachusetts: Marine invertebrates. 4104 (VIII).

COLEMAN, A. P., Toronto, Ontario, Canada: Interglacial fossil shells. 4432 (32145) (VI).

COLLEY, J. W., Little Rock, Arkansas: Mineral. (Returned.) 3941 (XII).

COLSON, J. M., Petersburg, Virginia: Shell; plant. 3804 (VI, XI).

COMBS, J., Hinton, West Virginia: Ores, minerals. (Returned.) 4005, 4234, 4255, 4265 (XIII, XII).

COMSTOCK, Prof. J. H. (See under Cornell University.)

CONNER, DANIEL, San Pedro, California: Ore. (Returned.) 4202 (XIII).

CONYER, THOMAS, Cotton Town, Tennessee: Ore. (Returned.) 4406 (XIII).

COOK, Prof. O. F., U. S. National Museum: Land shells from Liberia. 3906 (portion returned and remainder retained, 31093). (VI.)

COOKE, W. H., Fort Collins, Colorado: Bird skin. (Returned.) 4315 (II).

COOPER, C. A., Silverton, Colorado: Minerals. 4037 (XII).

COOPER, J. G. (See under California Academy of Sciences.)

COOPER, M. F., Awalt, Tennessee: Ore. (Returned.) 3869 (XIII).

COPLEY, EUGENE, Denton, Texas: Two birds' skins. (Returned.) 4267 (II).

CORCORAN, Mrs. THOMAS, Alexandria, Indiana: Mineral. (Returned.) 4455 (XII).

CORDER, J. E., Pearce, Arizona: Ore. (Returned.) 4313 (XIII).

CORDLEY, A. B. (See under Oregon State Agricultural College.)

CORNELL UNIVERSITY, Ithaca, New York, transmitted by Prof. J. H. Comstock: Mollusks; marine invertebrates. 4262 (VI, VIII).

COURCIER, LOUIS, Nicely, Oklahoma: Human skull and pieces of rock resembling petrified bone. 4068 (Returned.) (XIV).

COUPER, E. F., Azalia, Michigan: Insects. 3809 (VII).

COURTNEY, C. W., Doniphan, Idaho: Substance resembling chalk. 4457 (XIII).

C. H. COWDREY MACHINE WORKS, Fitchburg, Massachusetts: Specimen of wood. 4169 (31687) (XVII).

CRANFORD, W. H. H., Navajoe, Oklahoma: Ore. (Returned.) 4025 (XIII).

DAHLER, C. L., Helena, Montana: Mineral. 3854 (XII).

DANIELS, L. E., Laporte, Indiana: Land and fresh-water shells. 4129 (portion returned and remainder retained, 31592). (VI.)

DAVIE, OLIVER, Columbus, Ohio: Bird skin. (Returned.) 4302 (II).

DAVIS BROTHERS, Diamond, Ohio: Broken valve of a fossil. (Returned.) 4052 (VI).

DAVIS, H. N., Providence, Rhode Island: Specimens of coleoptera. (Returned.) 4042, 4207, 4232 (VII).

DAYTON, Hon. A. G., House of Representatives: Mineral. (Returned.) 4448 (XIII).

DENNISON, G. W., Smith's Island, Washington: Bird's egg. (Returned.) 4438 (II).

DEXTER, GEORGE, Little Hocking, Ohio: Carved stone pipe from West Virginia. (Returned.) 3959 (XIV).

DEYROLLE, E. (sons), Paris, France: Bird of paradise. (Returned.) 4387 (II).

DICKINSON, T. A. (See under Worcester Society of Antiquity.)

DILLARD, Dr. RICHARD, Edenton, North Carolina: Mushrooms. 3989 (XI).

DILTZ, J. M., Council Bluffs, Iowa: Three specimens of minerals. (Returned.) 4024 (XII).

DIMMICK, GEORGE, Yorkville, Michigan: Moth. (Returned.) 4453 (VII).

DIPPIE, G. F., Toronto, Ontario, Canada: Bird skin. (Returned.) 4040 (II).

DONOVAN, S. O., Salt Lake City, Utah: Rock. (Returned.) 4160 (XIII).

DRAKE, C. F., Weiser, Idaho: Ore. (Returned.) 4071 (XIII).

DRAKE, C. M., Tacoma, Washington: Six starfishes. (Returned.) 4019 (VIII).

DRAKE, Mrs. C. M., Tacoma, Washington: Shells. 4173 (32312) (VI).

DROWNE, F. P., Providence, Rhode Island: Forty-four specimens of coleoptera. (Returned.) 3870 (VII).

DUERDEN, J. E. (See under Jamaica, Institute of.)

DUNBERGER, H., Stewartsville, Indiana: Supposed fossil tooth of a mammal. (Returned.) 3990 (IX.)

DUNNING, E. H., Salt Lake City, Utah: Mineral. (Returned.) 3871 (XII).

DUVALL, J. C., Bunker Hill, Kansas: Mineral. (Returned.) 4146 (XII).

DWIGHT, Dr. JONATHAN, jr., New York City: Bird skin. (Returned.) 4125 (II.)

EAGLE, SETH, Powersville, Missouri: Ore. (Returned.) 4148 (XIII.)

ECKART, Miss E., San Francisco, California: Substance resembling lime. (Returned.) 4100 (XIII).

ELGIN, WALTER, Buffalo, Wyoming: Rocks. (Returned.) 4175 (XIII).

ENGELKE, H. N., Danville, Virginia: Caterpillars. (Returned.) 3900 (VII.)

ENGLISH, ERNEST, Rhinecliff, New York: Wax impression of an old coin. (Returned.) 4001 (XVII).

EVANS, S. B., Ottumwa, Iowa: Small brass nut, and a piece of bituminous coal in which it was embedded. (Returned.) 4395 (XIV).

EVERETT, J. J., National Military Home, Kansas: Clover seed. 4468 (32723) (XI).

EVRARD, I. N., Greenfield, Missouri: Insect. (Returned.) 4472 (VII).

FAHNSTOCK, A. L., Gladford, Illinois: Archæological objects. (Returned.) 4208 (XIV).

FALLIN, B. F., Myrtle Creek, Oregon: Mineral. (Returned.) 4444 (XII).

FARMER, A. M., Clinton, Massachusetts: Set of birds' eggs and a hawk. (Returned.) 4083 (II).

FAULKNER, HARRY, Denver, Idaho: Rock. (Returned.) 4229 (XIII).

FEARNLEY, JOHN, Monroe, Louisiana. Insect. (Returned.) 4456 (VII).

FELTER, P. S., Alberene, Virginia: Supposed meteorite. (Returned.) 4398 (XII).

FERGUSON, W. F., Walker, Arizona: Mineral. (Returned.) 4149 (XII).

FIELD COLUMBIAN MUSEUM, Chicago, Illinois: Bird skin; plants. (Returned.) 4261, 4466 (II–XI).

FILER, W. B., New York City: Four mammal skins from Efulen, Cameroons Mountains, West Africa; 60 birds' skins from the same locality. 4477 (32298) (I, II).

FISH COMMISSION, U. S.: River shrimp from North Carolina; ovaries and stomach contents of fur-seal. 4056 (31387), 4085 (VIII; IX).

FISHER, A. W., Brooklyn, Michigan: Beetle. (Returned.) 4345 (VII).

FISHER, W. H., Baltimore, Maryland: Stone implements. (Returned.) 4205 (XIV).

FLEMING, J. H., Toronto, Ontario, Canada: Birds' skins. 3896 (portion returned and remainder retained, 31097); 4181 (returned). (II.)

FLETCHER, W. A., Rhodelia, Tennessee: Mineral. (Returned.) 3787 (XII).

FLEWELLEN, E. A., The Rock, Georgia: Eggs of an insect. 4288 (VII).

FOLSOM, J. F., Rock Mills, Alabama: Ore. 4128 (XIII).

FORD, ALFRED, Wallsburg, Utah: Hair ball. (Returned.) 4341 (IX).

FORD, G. B., Lore City, Ohio: Ore. (Returned.) 4257 (XIII).

FORTSON, Dr. J. R., Kiowa, Indian Territory: Mineral. (Returned.) 4384 (XII).

FOSTER., G. H., Baker City, Oregon: Geological material. (Returned.) 3792 (XIII).

FOWLER, ROBERT, Omro, Wisconsin: Copper implement. (Returned.) 4244 (XIV).

FRANCE, W. N., Ashland, Ohio: Rock. (Returned.) 4440 (XIII).

FRANK, J. S., Chester, Ohio: Bone of a fish. (Returned.) 4072 (V).

FREDERICKSON, C. G., Rush Point, Minnesota: Minerals. (Returned.) 3789 (XII).

FREEMAN, D. N., Cardington, Ohio: Larva of an insect. (Returned.) 3836 (VII).

FREEMAN, J. R., Washington, District of Columbia: Fungus. 3931 (XI).

FREY & HILL, Sacramento, California: Rock. (Returned.) 3860 (XIII).

FRIEL, JOSEPH, Victoria, Kentucky: Larva of an insect. (Returned.) 3884 (VII).

FRIEND, E. N., Gloucester, Massachusetts: Moth. (Returned.) 4447 (VII).

FRIERSON, LORRAINE S., Frierson's Mill, Louisiana: Unionidæ from Louisiana and Virginia. 3842 (returned); 3933 (portion returned and remainder retained, 31127); 4051 (returned); 4193 (portion returned and remainder retained, 31640); 4280 (portion returned and remainder retained, 31833); 4452 (returned). (VI.)

FROHMAN, EDWARD, Columbus, Indiana: Fish bone. (Returned.) 4355 (V).

FROST, RAY, Rockerville, South Dakota: Ore. (Returned.) 4154 (XIII).

GARLINGTON, S. D., Laurens, South Carolina: Minerals. (Returned.) 4213 (XII).

GAY, MISS AGATHA, Staunton, Virginia: Plant. 3790 (XI).

GEORGE, N. H., Rocky Comfort, Arkansas: Copper coin. (Returned.) 4412 (XVII).

GERRARD, E., London, England: Ten Birds of Paradise. (Returned.) 4011 (II).

GETMAN, Dr. A. A., Chaumont, New York: Fragment of a bowlder. 4022 (XIII).

GILLETTE, Mrs. IRENE H., Buncombe, Wisconsin: Geological material; fossils; mineral. (Returned.) 4249; 4314 (XIII; X-B; XII).

GILLIAM, W. H., Collbran, Colorado: Ore. (Returned.) 4389 (XIII).

GILLILAND, Rev. J. D., Salt Lake City, Utah: Coin. (Returned.) 4300 (XVII).

GIVEN, J. F., Decatur, Illinois: Photograph showing both sides of a metal medallion, and a medal from the catacombs at Rome. 4309, 4388 (XVII).

GOLDSMITH, I., Duncan, Arizona: Supposed slate or soapstone. (Returned.) 4346 (XIII).

GOODFELLOW, W. B., Navajoe, Oklahoma: Ore. (Returned.) 4136 (XIII).

GOTTSCHALL, A. H., Harrisburg, Pennsylvania: Archæological objects. (Returned.) 4137 (XIV).

GOULD, C. N., Winfield, Kansas: Fossils. (Returned.) 3965 (X-B).

GRAHAM, G. A., Graham, Texas: Copper coin. (Returned.) 4122 (XVII).

GRAHAM GRANITE AND MARBLE WORKS, Poughkeepsie, New York: Mica. (Returned.) 4014 (XIII).

GRAY, ROBERT, Silver Nails, New York: Mineral. (Returned.) 4421 (XII).

GREGER, D. K., Fulton, Missouri: Plants. 3785 (30884) (XI).

GRINNELL, JOSEPH, Pasadena, California: Birds' skins. (Returned.) 4091, 4145, 4219, 4405 (II).

GROGAN, J. J., Coal Creek, Colorado: Ore. (Returned.) 4131 (XIII).

GROSSE, HERMAN, Paraguay, Republic of Paraguay. Plants; insects. 4399 (XI, VII).

GUGLE, JAMES, Dayville, Oregon: Ore. (Returned.) 4221 (XIII).

GUILFORD, H. M., Minneapolis, Minnesota: Five birds' skins. (Returned.) 4116 (II).

HAINES, E. I., New Rochelle, New York: Bird's egg. (Returned.) 4420 (II).

HALL, ASA, Antreville, South Carolina: Rocks. (Returned.) 4392 (XIII).

HAMILTON, J. T., Seattle, Washington: Rock. (Returned.) 4141 (XIII).

HAMILINE UNIVERSITY, St. Paul, Minnesota, transmitted by Prof. H. L. Osborn: Four hundred and fifty-three species of marine shells from the Philippine Islands. 3932 (portion returned, and 56 specimens retained, 31123). (VI.)

HAMMOND, L. F., Rensselaer Falls, New York: Insect. (Returned.) 3810 (VII).

HARDY, MANLY, Brewer, Maine: Fish. 3852 (30984) (V).

HARMON, WILLIAM, Kane, Wyoming: Three specimens of ores. (Returned.) 3802 (XII).

HARRIS, G. E., Cassville, Missouri: Two specimens of ores. (Returned.) 3867 (XIII).

HARRIS, JAMES, McCook, Nebraska: Rock and ore. (Returned.) 4135, 4185 (XIII).

HARTZ, W. T., Fort Bayard, New Mexico: Two duck's heads. 4224 (II).

HARVEY, CLARA A., Hancock, Maryland: Geological material. (Returned.) 4301 (XIII).

HARVEY, Dr. G. W., Kanab, Utah: Coin. (Returned.) 4415 (XVII).

HATCH, W. A., South Columbia, New York: Fossil. (Returned.) 4018 (X-B).

HAVANER, J. B., Jefferson, North Carolina: Ore. (Returned.) 4407 (XIII).

HAYS, A. P., Portland, Oregon: Brass or copper buttons found in Indian graves on Vancouver Island. (Returned.) 3975 (XIV).

HEDGES, HENRY, Waterville, Washington: Rocks, minerals. 3922, 4385, 4491 (XIII, XII).

HEILEMAN, HOWARD, Phœnix, Arizona: Black mineral. (Returned.) 4277 (XIV).

HEILMAN, G. W., Argenta, Arkansas: Plant. 4012 (XI).

HEINZ, H. J., Pittsburg, Pennsylvania: Marine invertebrates. (Returned.) 4378 (VIII).

HENDERSON, J. B. Jr., Washington, District of Columbia: Marine shells from the Bahamas. (Returned.) 4019 (VI).

HERMAN, W. W., Boston, Massachusetts: Shells from Mauritius, Jamaica, and other localities. 4064 (portion returned and remainder retained, 31409) (VI).

HESSLER, ROBERT, Logansport, Indiana. Herbarium specimens. 4096 (31452) (XI).

HETHERINGTON, J. P., Belding, Michigan: White substance, for polishing gold and silver. (Returned.) 3828 (XIII).

HEYDE, Rev. H. T., Vera Cruz, Mexico: Birds' skins from Guatemala, Panama, and Ecuador. 3877 (portion returned, and remainder retained, 31516) (II).

HIGHTOWER, J. C., Ruidoso, New Mexico: Root. 4413 (XVII).

HILL, A. S. C., Vergennes, Vermont: Fossils, quartzite implements. (Returned.) 4099 (X-B, XIV).

HILL, H. R., Williamsport, Pennsylvania: Insects. 4074 (VII).

HILL, R. T., U. S. Geological Survey: Land shells from Jamaica, also fossil shells. (Returned.) 4326 (VI).

HILL, Dr. W. S., Augusta, Maine: Crustaceans. (Returned.) 4076 (VIII).

HILLS, LESLIE W., Fort Wayne, Indiana: Carved stone pipe from Ross County, Ohio, and a hook-shaped implement from Unicoi County, Tennessee. (Returned.) 4311 (XIV).

HIMES, CHARLES, Tillamook, Oregon: Mineral. (Returned.) 4166 (XII).

HOARE, H. P., National Military Home, Ohio: Vegetable. 4044 (XI).

HODGE, C. W., Bryantsville, Indiana: Ore. (Returned.) 4241 (XIII).

HOLCOMB, E. G., Brasher Iron Works, New York: Stone implement. 4097 (XIV).

HOLMAN, J., Normansville, New York: Tooth of a mammal. (Returned.) 4469 (I).

HOLMES, J. H., Seven Oaks, Florida: Land and marine shells. (Returned.) 3843, 4210 (VI).

HOLMES, S. B., Eagle Point, Oregon: Quartz. (Returned.) 4493 (XII).

HOLT, W. D., Holt, Kentucky: Bone of a fish. (Returned.) 4465 (V).

HOOD, S. B., Sparta, Illinois: Geological material. (Returned.) 4360 (XII).

HOOPES, J., West Chester, Pennsylvania: Birds' skins. (Returned.) 3943, 4236, 4375 (II).

HOPKINS, L. S., Lynchburg, Ohio: Stone implement. (Returned.) 3825 (XIV).

HOPKINS, Miss Sue, Melbourne, Florida: Plant. 3926 (XI).

HOTCHKISS, Mrs. L. B., Courtland, Alabama: French and Greek Testaments. (Returned.) 4373 (XVI).

HOURSTON, JOSEPH, Fort Alexander, Manitoba: Minerals. (Returned.) 4113 (XII).

HOWARD, M., Chicago, Illinois: Two frames containing photographs illustrating Buddhism in Ceylon, three frames containing photographs of natives and scenery in Ceylon, and a frame containing photographs of scenery in Ceylon. (Returned.) 4034 (XV, XVI, XVII).

HUDGIN, W. G., Hinton, West Virginia: Mineral, ore. (Returned.) 3928, 4069 (XIII).

HUGHES, EDWARD, Stockton, California: Five curiously-worked pieces of obsidian and a portion of a clay ball found in an ancient burial place. 4175 (XIV).

HUGHES, J. T., Somerset, Kentucky: Milkweed silk. 4027 (XI).

HUGHES, RALPH, Leavenworth, Washington: Plant; insect. (Returned.) 4423 (XI, VII).

HURD, E. O., Plainville, Ohio: Plant. 3966 (XI).

HUTCHINSON, I. W., Abbeville, South Carolina: Ore, and monazite after the reduction of ore. 3894 (XIII).

HUTCHINSON, Dr. W. F., Winchester, Virginia: Mammal skin. (Returned.) 4290 (I).

HYDE, G. L., Springville, Utah: Supposed fire-clay. (Returned.) 4274 (XIII).

IJIMA, I. (See under Science College, Imperial University, Tokyo, Japan.)

IMPERIAL NATIONAL MUSEUM, Uneno Park, Tokyo, Japan: Birdskin. (Returned.) 4303 (II).

ISBELL, A. M., Merle, Texas: Spider. 4203 (VII).

JAMAICA, INSTITUTE OF, Kingston, Jamaica, transmitted by J. E. Duerden: Two species of crabs. (Returned.) 4127 (VIII).

JARVIS, P. W., Kingston, Jamaica: Corals and crabs. 3808 (portion returned, and remainder retained, 32588). (VIII.)

JAY, R. G., Dexter, Kansas: Supposed meteorite. (Returned.) 3939 (XII).

JENCKS, Mrs. A. H., Buncombe, Wisconsin: Twenty-two specimens of minerals. (Returned.) 4338 (XII).

JESTER, S. D., Wiggs, Arkansas: Two beetles. (Returned.) 3778 (VII).

JOHNSON, J. L., Duffield, Virginia: Fossil shells; archæological objects. 4485 (shells returned, remainder retained as an exchange, 32326). (X–B; XIV.)

JOHNSON, T. K., Guthrie, Oklahoma: Insect. (Returned.) 3824 (VII).

JOHNSON, W. A., Galesburg, Illinois: Four birds' eggs. (Returned.) 4479 (II).

JOHNSTON, F. J., New Carlisle, Ohio: Worm. 4382 (32353) (VIII–A).

JONES, J. B., Donald, West Virginia: Ores. (Returned.) 4144 (XIII).

JUDSON, W. B., Highland Park, California, transmitted by Major Bendire: Humming birds. (Returned.) 3910 (II).

KEANEY, W. M., De Soto, Missouri: Herb. 4298 (31845) (XI).

KEARNEY, J. J., Helotes, Texas: Supposed meteorite. (Returned.) 3957 (XII).

KEFFER, C. A. (See under Maloney, Sir Alfred.)

KEITH, E. H., Halleck, California: Mineral. (Returned.) 4223 (XII).

KENDALL, S. COY, Deckertown, New Jersey: Minerals. (Returned.) 4098 (XII).

KENNER, J. L., Jr., Peoria, Illinois: Insect. 3902 (VII).

KENT SCIENTIFIC INSTITUTE, Grand Rapids, Michigan, transmitted by C. A. Whittemore: 102 birds' skins from Guatemala; mammal skin from Honduras. 3794 (returned); 4396 (II, I).

KETCHAM, MACK, Victor, Indiana: Specimen resembling clay. (Returned.) 4427 (XIII).

KEYES, CHARLES R., Mount Vernon, Iowa: Three birds' skins. (Returned.) 3814 (II).

KIMBALL, G. N., Waltham, Massachusetts: Insects. (Returned.) 4253 (VII).

KINDLE, E. M., New Haven, Connecticut: Fossil plants from Greenland. 4092 (31529) (X–B).

KIRKLAND, Dr. R. J., Grand Rapids, Michigan: Shells. 3827 (portion returned and remainder retained, 31600). (VI.)

KIRKPATRICK, O., Hunt, Idaho: Ore. (Returned.) 4165 (XIII).

KIRKWOOD, F. C., Baltimore, Maryland: Bird skin. 3890 (II).

KLECKNER, M. E., Tiffin, Ohio: Crystals. (Returned.) 4342 (XII).

KLEIN, ANTON, Flagstaff, Arizona: Rock and clay. (Returned.) 4194 (XIII).

KNAUS, WARREN, McPherson, Kansas: Twenty-two specimens of coleoptera. (Returned.) 4059 (VII).

KNIGHT, ORA W., Bangor, Maine: Bird skin. (Returned.) 4158 (II).

KOGALE, J. W., Halfway, Oregon: Insect. (Returned.) 3862 (VII).

KOHLDE, GEORGE, Portland, Oregon: Geological material. (Returned.) 4417 (XIII).

KRUEGER, P. W., Cleveland, Ohio: Insects (portion returned and remainder retained, 32046). (VII.)

KUEHN, H. R., Giddings, Texas: Stones. (Returned.) 4482 (XIII).

KUNZIE, Mrs. HELEN KANE, Umatilla, Oregon: Two archæological objects. 4312 (31875) (XIV).

KYLE, D. P., and WALL, W. W., Phœnix, Arizona: Piece of supposed meteoric stone found on Weaver Mountain; supposed meteoric stone. (Returned.) 3822, 3863 (XII).

LANCASTER, J. R., Arcadia, Florida: Vertebra of a whale and other vertebrate fossils. (X-A.)

LANO, ALBERT, Aitkin, Minnesota: Birds' skins. (Returned.) 3800, 4117 (II).

LASSIMONNE, S. E., Moulins (Allier) France: Plants. 4079 (31428) (XI).

LAWRENCE, FRANK, Centerville, South Dakota: Insect. (Returned.) 4181 (VII).

LEAK, H. A., St. Louis, Missouri: Spider. (Returned.) 3831 (VII).

LEARY, J. L., San Marcos, Texas: Minerals. (Returned.) 4467 (XII).

LEE, JOSEPH, St. Augustine, Florida: Shell. (Returned.) 4281 (VI).

LEE, Prof. W. T., University of Denver, University Park, Colorado: Supposed fossil reptiles. (Returned.) 4305 (IX).

LEFFLER, P. W., Chicago, Illinois: Mineral. (Returned.) 4070 (XII).

LEMON, Dr. J. H., New Albany, Indiana: Insect. (Specimen lost during transportation.) 3821 (VII).

LEWMAN, WILLIAM, Henrieville, Utah: Geological material; crystal. (Returned.) 3976, 4247 (XIII, XII).

LINK, E. S., Jefferson City, Missouri: Plant. 4435 (XI).

LIPSCOMB, J. L., Crockett, Texas: Sternum of a quadruped. (Returned.) 3995 (I).

LISK, Dr. B. F., Connor, Florida: Minerals. (Returned.) 3853 (XII).

LITTLEJOHN, C., Redwood City, California: Ten birds' skins and a bird skull from California. (Returned.) 3986 (II).

LITTLEPAGE, G. C., Haubstadt, Indiana: Mineral. (Returned.) 3877 (XII).

LIVINGSTON, L. O., New Brighton, Pennsylvania: Ore. (Returned.) 4015 (XIII).

LOCKE, W. M., White Salmon, Washington: Ore. (Returned.) 4225 (XIII).

LOOMIS, L. M. (see under California Academy of Sciences).

LOPTON, H., St. Francisville, Louisiana: Fossil coral. (Returned.) 4251 (X-B).

LORBEER, E. A., Yallaha, Florida: Stone. 4365 (XIII).

LORENSON, J. P., Salt Lake City, Utah: Plants. 4486 (XI).

LOWE, H. N., Pasadena, California: Crabs, star-fishes, and sea-urchins. 4206 (31675) (VIII).

LYMAN, DON, Perry, Oregon. Insect. (Returned.) 3872 (VII).

LYON, D. B., Sherman, Texas: Caterpillar. 4480 (VII).

LYONS, J. S., Boyers Ferry, Virginia: Mineral. (Returned.) 4284 (XII).

LYTLE, F. W., Steeple Rock, New Mexico: Rock. (Returned.) 4414 (XIII).

MCBRIDE, WILLIAM, Doverhill, Indiana: Ore. (Returned.) 4254 (XIII).

MCCARTY, J. A., Aldie, Virginia: Stone. (Returned.) 4120 (XIII).

MCCASKILL BROTHERS, Wyoma, Florida: Clay and sand. (Returned.) 3813 (XIII).

MCCORMICK, D. B., Tylersburg, Pennsylvania. Fragments of rock. 4308 (XIII).

MCILHENNY, E. A., Averys Island, Louisiana: Three birds' skins. (Returned.) 3927 (II).

MCINNIS, A. H., Meridian, Mississippi: Insect. (Returned.) 3964 (VII).

MCKINNEY, C. S., Las Animas, Colorado: Mineral. (Returned.) 4279 (XII).

MCLUCAS, J. D., Marion, South Carolina: Insect. (Returned.) 4307 (VII).

MCNEILL, JEROME, Arkansas Industrial University, Fayetteville, Arkansas: Spider. (Returned.) 4067 (VII).

MCPHAIL, W. H., Moscow, South Carolina: Minerals. (Returned.) 4266 (XII).

MAGOON, J. H., Lusk, Wyoming: Portion of a mastodon's tooth. (Returned.) 4065 (IX).

MAHONEY, J. D., Duluth, Minnesota: Supposed meteorite. (Returned.) 4259 (XII).

MANNING, T. H., Boise, Idaho: Ore. (Returned.) 4339 (XII).

MANSFIELD MEMORIAL MUSEUM, Mansfield, Ohio, transmitted by E. Wilkinson: Collection of insects. 4155 (portion returned and remainder retained, 31624) (VII).

MARQUIS, A. A., Boscoe, Missouri: Ore. (Returned.) 4484 (XIII).

MARSH, Prof. O. C., New Haven, Connecticut: Types of horn-cores of two fossil bison. (Returned.) 4216 (X-A).

MARSH, W. A., Aledo, Illinois: Unios. 4031 (portion returned and remainder retained, 31298); 4084 (portion returned and remainder retained, 31410). (VI.)

MARTIN, W. W., Salem, Oregon: Stone. (Returned.) 4334 (XIII).

MAXWELL, C. W., Durham, North Carolina: Insect. (Returned.) 4359 (VII).

MAXON, W. R., Oneida, New York: Insect. 3903 (VII).

MAXWELL, HUGH, St. George, West Virginia: Sample of dust obtained by melting snow. 4272 (31834) (XIII).

MAYO, W. L., West Creek, Colorado: Sample of sand. (Returned.) 4167 (XIII).

MEADOR, J. F., Phœnix, Arizona: Insect. 3907 (31806) (VII).

MEARNS, Dr. E. A., U. S. A., Fort Myer, Virginia: Land and fresh-water shells from the Potomac, New York, and Minnesota. 4035 (portion returned and remainder retained, 31342); 4296 (portion returned and remainder retained, 31986); 4348 (portion returned and remainder retained, 31986). (VI.)

MESNAGER, G. K., Los Angeles, California: Ore. (Returned.) 3949 (XIII).

METCALF, W. W., Paint Gap, North Carolina, transmitted by Hon. Marian Butler: Ore. (Returned.) 4191 (XIII).

MILLER, J. H., Lowville, New York: Six birds' skins. (Returned.) 4258 (II).

MILLER, M. M., Seattle, Washington: Minerals. (Returned.) 3818 (XII).

MITCHELL, D. L., Cassville, Missouri: Insect. 4431 (VII).

MOLONEY, SIR ALFRED, Belize, British Honduras, transmitted by Charles A. Keffer: Fossils from British Honduras; two geological specimens; ore, 3820 (30933); 3893 (one specimen returned); 3923 (returned); 3955 (returned) (VI, XIII).

MORCOM, G. FREAN, Los Angeles, California: Fourteen birds' skins. 3985 (II).

MORGAN, J. H., Aquone, North Carolina: Minerals. (Returned.) 4114 (XII).

MOORE, TOM, Genoa Junction, Wisconsin: Two stones. (Returned.) 4112 (XIV).

MOOREHEAD, W. K., Columbus, Ohio: Aboriginal inscription on birch bark. 4238 (XIV).

MORRIS, L., Hamburg, Illinois: White and blue substance resembling fuller's earth. (Returned.) 4073 (XIII).

MORRISON, J. H., Luray, Virginia: Specimen of slate. (Returned.) 4364 (XIII).

MOSIER, C. A., Des Moines, Iowa: Bird skin; iron-pyrite nodule. (Returned.) 3779; 4487 (II, X-B).

MYER, W. E., Carthage, Tennessee: Supposed fossil bone; supposed fossil tooth of a mammal; piece of fossil wood; supposed fossil tooth of a horse. 4450; 4198; 4063; 4475. (I, IX, X-B).

NATURAL HISTORY SOCIETY, Montreal, Canada, transmitted by J. B. Williams: Four birds' skins from Malaysia. (Returned.) 4081 (II).

NEGLEY, J. S., New York City: Clay from Pennsylvania. (Returned.) 3912 (XIII).

NELSON, E. E., Kettle Falls, Washington: Rock. (Returned.) 3969 (XIII).

NELSON, Hon. KNUTE. (See under Arnesen, Bernt.)

NEVILLE, E. A., Austin, Texas: Birds' eggs. 4153 (31579); 4488 (returned) (II).

NEWTON, Prof. ALFRED, Magdalene College, Cambridge, England: Two birds' skins from the Seychelles Islands. (Returned.) 3917 (II).

NIVEN and HOPPING, New York City: Mammal skin and skull. 3817 (31012). (I.)

NIXON, H. B., Marquette, Kansas: Mineral. (Returned.) 4170 (XII).

NOERENBERG, F., Cascade Springs, South Dakota: Two specimens of rock. (Returned.) 4361 (XIII).

NÖRDSTRÖM, G. H., Punxsutawney Pennsylvania: Two spiders. 3947 (31807) (VII).

NOXON, ALFRED, Silver Cliff, Colorado: Samples of rock. (Returned.) 4152 (XIII).

NYE, G. L., Salt Lake City, Utah: Ore. (Returned.) 4381 (XIII).

O'NEIL, J. H., Roslyn, Washington: Ore. (Returned.) 3961 (XIII).

OGBURN, BURT, Phœnix, Arizona: Geological specimens and fragments of shell rings. 4009 (returned); 4222 (31742); (XIII, XIV).

OLNEY, Mrs. MARY P., Spokane, Washington: Land, fresh-water and marine shells from western North America. 4188 (portion returned and remainder retained, 31629). (VI.)

Oregon State Agricultural College, Corvallis, Oregon, transmitted by A. B. Cordley: Marine invertebrates. 4293 (returned with exception of one specimen, 32226) (VIII).

Orth, G. S., Pittsburg, Pennsylvania: Bird skin. (Returned.) 4393 (II).

Osborn, Prof. H. L., Hamline University, St. Paul, Minnesota: Unionidæ; shells from Philippine Islands. (Returned.) 4026, 4172, 4269 (VI). (See under Hamline University.)

Osborne Brothers, Frisco, Utah: Rock. (Returned.) 4368 (XIII).

Owen, E. R., Wellsville, Utah: Bronze statuette. (Returned.) 3958 (XVI).

Palm, Charles, New York City: Three species of insects. (Returned.) 3991 (VII).

Palmer, F. T., Department of the Interior, Office of Indian Affairs: Rocks. (Returned.) 4306 (XIII).

Palmer, J. W., Port Republic, Virginia: Ore. (Returned.) 4325 (XII).

Parker, J. Grafton, Chicago, Illinois: Six birds. (Returned.) 4093 (II).

Parkins, S. B., Ferris, Wyoming: Rock. (Returned.) 4230 (XIII).

Parmelee, H. P., Cripple Creek, Colorado: Ore. (Returned.) 4285 (XII).

Parmenter, C. S. (See under Baker University.)

Parsons, E. S., Parsons, New Mexico: Ore. (Returned.) 4233 (XIII).

Parsons, Dr. W. B., Missoula, Montana: Insects. (Returned.) 3914 (VII).

Payne, H. R., Yellville, Arkansas: Ore. (Returned.) 4260 (XIII).

Peake, J. J., Wimer, Oregon: Minerals. (Returned.) 4032 (XII).

Pearce, C. W., Arcadia, Florida: Four mammals' skins and 13 birds' skins from Florida. 3960 (31192) (I, II).

Perkins, E. M., Rixville, Georgia: Insect. (Returned.) 3921 (VII).

Peter, Brother, J., De la Salle Institute, New York City: Ten plants. 3850 (XI).

Petter, A. J., Randsburg, California: Minerals. 4419 (XII).

Pierce, W. M., Burlington, Vermont: Minerals. (Returned.) 4318 (XII).

Pilsbry, H. A., Academy of Natural Sciences, Philadelphia, Pennsylvania: Six species of Unios; three species of fresh-water shells from South America. 3874 (portion returned and remainder retained, 31018); 3982 (returned). (VI.)

Plant City Supply Company, Plant City, Florida, transmitted by W. H. Young: Coin. (Returned.) 4403 (XVII).

Pohndorf, A. P., Butte, Montana: Ore. (Returned.) 4121 (XIII).

Poland, W. P., Marshall, Texas: Ore. (Returned.) 4252 (XIII).

Pollard, C. L., U. S. National Museum: Two plants from Mississippi. 3849 (XI).

Pool, M. B., Clinton, Iowa: Clay. (Returned.) 4183 (XIII).

Price, L. B., McMeekin, Florida: Stone. (Returned.) 3974 (XIII).

Price, W. W., Stanford University, California: Six birds' skins. (Returned.) 4217 (II).

Priestley, C. H., Elm, New Jersey: Lignite. (Returned.) 3832 (XII).

Prindle, I. R., Washington, District of Columbia: Ore. (Returned.) 4226 (XIII).

Pringle, C. G., Charlotte, Vermont: Mexican plants. (Returned.) 4090 (XI).

Quick, J. G., Coudersport, Pennsylvania: Copper coin. (Returned.) 4321 (XVII).

Raatz, Frederic, Jefferson, Wisconsin: Mineral. (Returned.) 4178 (XII).

Rambo, M. E., Philadelphia, Pennsylvania: Clay. 3819 (XIII).

Rankin, A. W., Salt Lake City, Utah, transmitted by Hon. C. E. Allen: Ore. (Returned.) 3866 (XIII).

Rathbun, Richard, U. S. Fish Commission: Marine shells and mollusks from the southeastern coast of the United States. (Returned.) 3882 (VI).

Ream, G. W., Whitehall, Montana: Rock. (Returned.) 4335 (XIII).

Reddy, F. J., White Hills, Arizona: Ore. (Returned.) 4271 (XIII).

Redman, D. M., Tarkio, Missouri: Paper money. (Returned.) 3938 (XVII).

Reed & Ross, Cripple Creek, Colorado: Mineral. (Returned.) 4050 (XII).

Reeder, T. P., Big Flats, New York: Grass. 3864 (XI).

Remick, A. B., Taylorsville, California: Sand. 4010 (XIII).

RICE, Miss M. E., Neligh, Nebraska: Three insects. (Returned.) 3804 (VII).

RICH, J. E., San Bernardino, California: Mineral. (Returned.) 4390 (XII).

RICHARDSON, J. E., Rowley, Massachusetts: Bead from a shell mound. (Returned.) 4391 (XIV).

RICHARDSON, Master WILLIE, Blockhouse, Washington: Insect. (Returned.) 4492 (VII).

RICHMOND, Capt. E. T. C., U. S. A., Fort Warren, Boston, Massachusetts: Flowers. 3925 (XI).

RICHTER, EDWARD F. & SON, Cairo, Georgia: Clay. (Returned.) 4483 (XIII).

RIEGGER, Miss MATHILDE, Champion Quarries, Pennsylvania: Plants. 3919 (XI).

ROBERTS, W. J., Harrisville, Pennsylvania: Insect. (Returned.) 3859 (VII).

ROBERTSON, C. B., Indiana, Pennsylvania: Stone. (Returned.) 3807 (XIII).

ROBINETTE, G. W., Flagpond, Virginia: Five species of Unios; Unios from Virginia. 3905 (returned); 3993 (31208) (VI).

ROBINETTE, J. B., Flagpond, Virginia: Unios from Virginia and North Carolina. 3887 (portion returned and remainder retained, 31051). (VI.)

ROBINETTE, J. M., Democrat, Virginia: Fresh-water shells. (Returned.) 4347 (VI).

ROBINSON, HENRY, Geological material. (Returned.) 4021 (XIII).

ROHAN, MIKE, Kane, Wyoming: Rock. (Returned.) 3929 (XIII).

ROMEYN, Capt. HENRY, U. S. A., Fort McPherson, Georgia: Insects. 3793; 3823 (VII).

ROOT & FIELD, Kilbourne, Illinois: Insect. 4426 (32150). (VII.)

ROSE, O. G., San Rafael, California: Six birds' skins. (Returned.) 4106; 4151 (II).

ROSENTHAL, ALBERT, Philadelphia, Pennsylvania: Collection of portraits. (Returned.) 4184 (XVII).

ROSS, HENRY, Weimer, Arkansas: Copper coins. (Returned.) 4124 (XVII).

RULAND, H., San Antonio, Texas: German coin. (Returned.) 3788 (XVII).

RUSH, R. C., Hudson, Ohio: Land and fresh-water shells. (Returned.) 4161 (VI).

RUSH, WESLEY, Tillamook, Oregon: Rock. (Returned.) 4336 (XIII).

RUSSELL, J. R., Boise City, Idaho: Ores. 3826 (XIII).

SALAMON, W. R., Pryor Creek, Indian Territory: Ore. (Returned.) 3889 (XIII).

SALVIN, OSBERT, London, England: Thirty-three birds' skins from tropical America. (Returned.) 4474 (II). (See under British Museum.)

SANDERS, P. D., Haskell, Texas: Ore. (Returned.) 4380 (XIII).

SANDERS, R. F., Marianna, Florida: Ore. (Returned.) 4122 (XIII).

SANDISON, G. H., New York City: Impressions of four coins. (Returned.) 4264 (XVII).

SAUNDERS, W. G., New Bridge, Oregon: Insect. 4057 (31808) (VII).

SAVAGE, M. F., New York City: Death mask cast in metal resembling iron, found in 1879 in a mound in Milan, Missouri. (Returned.) 3920 (XIV).

SCHAUPP, T. G., Shovelmount, Texas: Plant. 4459 (XI).

SCHNEIDER, WILLIAM, Jefferson City, Missouri: Insect. (Returned.) 3913 (VII).

SCHREIBER, J. D., Allentown, Pennsylvania: Minerals. (Returned.) 3942 (XII).

SCHWEICH, GEORGE, Richmond, Missouri: Drilled tablet. (Returned.) 4054 (XIV).

SCIENCE COLLEGE, IMPERIAL MUSEUM, Tokyo, Japan, transmitted by I. Ijima: Bird-skin; snake. 4304 (returned); 4430 (II, IV).

SCOTT, G. H., Sault de St. Marie, Michigan; transmitted by E. S. Wheeler: Copper spearhead. 3841 (31095) (XIV).

SCOTT, W. A., Rifle, Colorado: Supposed meteorite. (Returned.) 4439 (XII).

SCOTT, Prof. W. B., Princeton University, Princeton, New Jersey: One hundred and eleven birds' skins; birds' bones. 4464 (portion of birds' skins returned and remainder retained, 32297; also portion of birds' bones returned, and skeleton of condor retained) (II, IX).

SEIFFERT BROTHERS, Spokane, Washington: Mineral. (Returned.) 4349 (XII).

SENTANCE, C. B., Bartley, Nebraska: Three supposed fossil teeth. (Returned.) 4433 (X–B).

SEMMENS, HENRY, Seattle, Washington: Ore. (Returned.) 3784 (XII).

SETTLEMYER, C. T., Wilmore, Pennsylvania: Bees. (Returned.) 4053 (VII).

SHEPARD, H. C., Boulder Valley, Montana: Ores. 4295 (XIII).

SHERMAN. C. A., Manville, Wyoming: Geological material. (Returned.) 4239 (XIII).

SHIPLEY, WILLIAM, Waynesville, Illinois: Archæological object. (Returned.) 4245 (XIV).

SHIPPY, N. D., West Palmdale, California: Minerals. (Returned.) 4323 (XII).

SHOUP, C. E., Tidal, Pennsylvania: Ore. (Returned.) 4033 (XIII).

SHUFELDT, Dr. R. W. (See under J. G. Wells.)

SHUGART, W. H., Newport, Tennessee: Mineral. (Returned.) 4256 (XII).

SHULER, J. T., Bloomery, West Virginia: Minerals. (Returned.) 4147 (XII).

SHRIVER, HOWARD, Cumberland, Maryland: Fossils; black-sand; land shells. 3846 (returned); 4060 (returned). 4310; 4409 (portion returned and remainder retained 32106) (X–B, XIII, VI).

SIDDY, Mrs. CHARLES, St. Louis, Missouri: Spider. (Returned.) 3830 (VII).

SIMPSON, R. L., Eufaula, Indian Territory: Insect. (Returned.) 4473 (VII).

SMITH, D. B., Clarksfield, Ohio: Geological specimen. (Returned.) 4470 (XIII).

SMITH, JOHN DONNELL, Baltimore, Maryland: Plants from Costa Rica. (Returned.) 4061 (XI).

SMITH, L. K., Caledonia, New York: Natural formation resembling a worked stone object. (Returned.) 4212 (XIV).

SMITH, R. E., Hazel Green, Wisconsin: Mineral. (Returned.) 3888, 3935 (XII).

SNYDER, Dr. F. D., Gaines, New York: Forty-six birds' skins. (Returned.) 4126 (II).

SNYDER, J. S., Two Taverns, Pennsylvania: Two geological specimens. (Returned.) 3987 (XIII).

SOUTHWICK, J. M., Providence, Rhode Island: Unionidæ; shells. (Returned.) 4329, 4356 (VI).

SPERRA, W. E., Randolph, Ohio: Rock. (Returned.) 4168 (XIII).

SPRECHER, N. D., Cearfoss, Maryland: Stone implement. (Returned.) 4046 (XIV).

SPRINKEL, J. W., Brightwood, Virginia: Larva of an insect. (Returned.) 3910 (VII).

SQUIERS, W. H., Keeblers Crossroads, Tennessee: Ore. (Returned.) 4186 (XIII).

SQUYER, HOMER, Wibaux, Montana: Shells. (Returned.) 4343 (VI).

STARKS, W. W., Hinton, West Virginia: Ore. (Returned.) 4139 (XIII).

STALLINGS, Hon. J. F., House of Representatives: Pistol. (Returned.) 4201 (XVII).

STANARD, R. C., Goshen Bridge, Virginia: Farewell address of Andrew Jackson printed on silk in the year 1837. (Returned.) 4263 (XVII).

STANLEY, D. T. (See under Aldrich, Charles.)

STANLEY, Mrs. T., Ashland, Oregon: Supposed meteorite. (Returned.) 4275 (XII).

STARKS, W. W., Hinton, West Virginia: Piece of metal. (Returned.) 4276 (XIII).

STARTIN, THOMAS, Mammoth, Utah: Ore. (Returned.) 3878 (XIII).

STEWART, T. B., Lockhaven, Pennsylvania: Stone, supposed to be an Indian relic; pipe from Schoharie County, New York, and a crooked flint from Union County, Tennessee. (Returned.) 4273, 4402 (XIV).

STERNBERG, FRED., New York City: Samples of fibrous serpentine. (Returned.) 4109 (XIII).

STEINHAUER, E. F., Vandalia, Illinois: Two birds. (Returned.) 4200 (II).

STEBINS, E., Conconully, Washington: Ores. (Returned.) 4176 (XIII).

STILES, Dr. C. W., Department of Agriculture: Shells. (Returned.) 3946, 3971 (VI).

ST. MARY'S ACADEMY (Sister M. Catherine), Monroe, Michigan: Shells from Japan; small silver cross; stone from Japan and an egg-shaped stone from Michigan. (Returned.) 4017 (VI, XVI, XIII).

STONE, WITMER, Academy of Natural Sciences, Philadelphia, Pennsylvania: Birds' skins. (Returned.) 3798, 3944, 4367 (II). (See under Academy of Natural Sciences, Philadelphia.)

STONEHOUSE, R. A., Olathe, Colorado: Rock. (Returned.) 3831 (XIII).

STOUGHTON, S., Windsor, Ohio: Clay. (Returned.) 3954 (XIII).

STRANAHAN, JULIUS, Keesville, New York: Ore. (Returned.) 4379 (XIII).

STREET, D., Denver, Colorado: Ore. (Returned.) 4086 (XIII).

STUART, R. C., Alton, Illinois: Insect; medal. (Returned.) 4041, 4246 (VII, XVII).

STUFFLEBEAM, J. G., Crosses, Arkansas: Ore, mineral. (Returned.) 3835, 3858 (XIII, XII).

SULLIVAN, A. E., Jamestown, Kentucky: Minerals. (Returned.) 4278 (XII).

SULLIVAN, JAMES, East Helena, Montana: Mineral. (Returned.) 4156 (XII).

TAGGERT, WILLIAM, Sutton, Tennessee: Ores. (Returned.) 3868 (XIII).

TALMADGE, C. A., Athens, Georgia: Terracotta pipe in form of an eagle's head. (Returned.) 4013 (XIV).

TAVERNIER, L., Hamburg, Illinois: Geological material. (Returned.) 3839, 3883, 3891 (XIII).

TAYLOR, E. W., Salt Lake City, Utah: Black substance found in red sand. 3892 (XIII).

TAYLOR, Miss K. A., Baltimore, Maryland: Plant. 3837 (XI).

TAYLOR, THOMAS, Emory, West Virginia: Ores. (Returned.) 3908 (XIII).

TEFFT, Dr. F. O., Tecumseh, Washington: Two fishes. 4369 (32265) (V).

TEGARDEN, W. S., Yellville, Arkansas: Mineral. 4000 (XII).

THAYER, A. H., Dublin, New Hampshire: Fifteen birds' skins. 4418 (32176) (II).

THOMAS, E. H., San Bernardino, California: Geological material. (Returned.) 4358 (XIII).

THOMAS, J. B., Colville, Washington: Ore. (Returned.) 4228 (XIII).

THOMPSON, GEORGE, Grand Rapids, Michigan: Piece of sheet lead; piece of tank lining of lead, containing perforations. (Returned.) 3796, 3856 (XIII, VII).

THOMPSON, H. D., Moline, Illinois: Pottery whistle in shape of an animal's head, and a small flint scraper. 4297 (Pottery whistle returned; scraper retained, 32264) (XIV).

THOMPSON, M. T., Providence, Rhode Island: Thirty-four species of hemiptera and orthoptera; hemiptera. 4115 (returned); 4286 (portion returned and remainder retained, 31814) (VII).

TIPTON, M. A., Orenville, South Dakota: Sand; lime rock. 3795, 4235 (XII, XIII).

TODD, J. F., Mena, Arkansas: Quartz ore. (Returned.) 4463 (XIII).

TOMS, C. F., Hendersonville, North Carolina: Minerals. 4330 (XII).

TONER, D. L., Chewelah, Washington: Ore. (Returned.) 3951 (XIII).

TOPLITZ, Mrs. R. L., San Francisco, California: Plant. 3970 (XI).

TOWNS, H. E., Fond du Lac, Wisconsin: Archæological object. (Returned.) 3782 (XIV).

TREASURY DEPARTMENT, United States: Sample of so-called "Latakia Tobacco" from New York. (Returned.) 4268 (XI).

TRUX, M. E., Hartford, Connecticut; Specimen of Owatonna meteoric stone. (Returned.) 3980 (XII).

TUCKER, A. S., Helena, Montana: Ore. (Returned.) 4133 (XII).

TUPPER, J. E., Chewelah, Washington: Ore. (Returned.) 4416 (XIII).

TUTTLE, FRANK, Glen Arbor, Michigan: Ore. (Returned.) 3962 (XIII).

TSCHUSI ZU SCHMIDHOFFEN, VICTOR RITTER VON, Halle, Austria: Seventeen birds' skins. 3816 (31073) (II).

UNDERWOOD, L. M., Auburn, Alabama: Cryptogams. (Returned.) 3661 (XI).

VAN HYNING, T., Des Moines, Iowa: Shells. 4377 (portion returned and remainder retained, 32037) (VI).

VAN ROON, G., Rotterdam, Holland: European coleoptera. (Returned.) 4006 (VII).

VON SCHMIDT, JARO, Tustin City, California: Plant. 3840 (XI).

WAGHORNE, Rev. S. C., Bay of Islands, Newfoundland: Plants. 3972 (33012); 3996 (33016) (XI).

WALDEN, H. L., Albany, Oregon: Material resembling cannel coal. (Returned.) 4428 (XIII).

WALDERS, K. O., Hamilton, Washington; Minerals, ores. (Returned.) 4319, 4410, 4436 (XII, XIII).

WALKER, BRYANT, Detroit, Michigan: Unios. (Returned.) 4003, 4089 (VI).

WALKER, JAMES, Carrollton, Illinois: Bone of a mammal. (Returned.) 3886 (IX).

WALKER, Rear-Admiral J. G., U. S. N., Los Angeles, California: Eleven stones from quarries in California. (Returned.) 4196 (XIII).

WALKER, W. C., Fairlie, Texas: Plant. (Returned.) 3987 (XI).

WALTER, CLARENCE, Spruce Creek, Pennsylvania: Insect. (Returned.) 3899 (VII).

WALL, W. W., and D. P. KYLE, Phœnix, Arizona: Piece of supposed meteoric stone. 3822 (XII).

WARD, F. A., Rochester, New York: Young bird. (Returned.) 3875 (II).

WARD, H. M., Dallas, Texas: Plant. 3865 (XI).

WARD & GARDNER, Jerome, Arizona: Rocks. (Returned.) 3898 (XIII).

WARD'S NATURAL SCIENCE ESTABLISHMENT, Rochester, New York: Five parrots. 4242 (two parrots returned and three retained, 31741); five mammal skins 4292 (31744); sixteen mammal skins 4372 (portion returned and reremainder retained, 32381) (II, I).

WARNER, C. C., Turrialba, Costa Rica: Stone. (Returned.) 4162 (XIII).

WARREN, W. C., Atlanta, Georgia: Plant. (Returned.) 4231 (XI).

WATRUS, P. B., Kiowa, Kansas: Supposed petrifaction. (Returned.) 4043 (VIII).

WATSON, Rev. W. SCOTT, Towerhill, Guttenberg, New Jersey: Insect. (Returned.) 4007 (VII).

WAYNE, A. T., Mount Pleasant, South Carolina: Birds' skins. 3805 (portion returned and remainder retained, 30906); 4030 (returned); 4045 (returned); 4327 (portion returned and remainder retained, 31970); 4353 returned); 4386 (portion returned and remainder retained, 32229); 4425 (returned); 4460 (returned) (II).

WEBB, W. F., Albion, New York: Heron from Florida; land shells; stone ornament from Canada. 3797 (30890); 4108 (portion returned and remainder retained, 31459), 4287 (returned) (II, VI, XIV).

WEBER, G. W., Opelika, Alabama: Leaf of a plant. 4471 (XI).

WEIL, I., Sandpoint, Idaho: Ore. (Returned.) 4080 (XIII).

WELLINGTON, Mrs. L. M., Green, Colorado: Mineral. (Returned.) 4107 (XII).

WELLS, J. G., Carriacou, Grenada, West Indies, transmitted by Dr. R. W. Shufeldt: Cuckoo. (Returned.) 4240 (II).

WERNER, R. J., Columbia Falls, Montana: Ore. (Returned.) 4182 (XIII).

WHEELER, E. S. (See under Scott, G. H.)

WHITE, J. J., Rockledge, Florida: Land, fresh-water, and marine shells. 4016 (portion returned and remainder retained, 31253); 4048 (portion returned and remainder retained, 31349) (VI).

WHITE, Dr. J. P. (See under Young Naturalists' Society.)

WHITEHORN, G. W., Rochester, Nebraska: Three specimens of grasses. 3783 (XI).

WHITESIDE, J. W., Brookville, Maryland: Supposed fossil shark's tooth. 4332 (IX).

WHITMAN, J., & SONS, Forestville, Virginia: Minerals. (Returned.) 4394 (XII).

WHITMER, T. W., Sacramento, Kentucky: Rock and stone. (Returned.) 4282; geological material, 4357 (XIII).

WHITTEMORE, C. A. (See under Kent Scientific Institute.)

WILCOX, G. A., Erie, Illinois: Larvæ of insects. (Returned.) 3934 (VII).

WILKINSON, E. (See under Mansfield Memorial Museum.)

WILLIAMS, C. M., Rochester, Indiana: Two geological specimens. (Returned.) 4354 (XIII).

WILLIAMS, J. B., Montreal, Canada: Three humming birds. (Returned.) 4442 (II). (See under Natural History Society, Montreal.)

WILLIAMSON, G., Grand Cave, Louisiana: Archæological objects. 4401 (XIV).

WILLIS, L. D., Church Creek, Maryland: Ants. 3968 (31233) (VI).

WILLSON, J. M., jr., Kissimmee, Florida: Fruit of a vine. 4283 (XI).

WILSON, B. F., Huntington, West Virginia: Archæological object. 4029 (31489) (XIV).

WING, C. L., Hematite, New Mexico: Ore. (Returned.) 4190 (XIII).

WINTHROP, G. J., Tallahassee, Florida: Three sets of birds' eggs. (Returned.) 4105 (III).

WITTMER, J. J., Wawaka, Indiana: Fragment of a supposed meteorite. (Returned.) 4478 (XII).

WOOD, CLARENCE T., Marion, New York: Insects. (Returned.) 4227 (VII).

WOOD, J. W., Batesville, Arkansas: Mineral. (Returned.) 4036 (XII).

WOODDELL, G. P., Seven Oaks, Florida: Echinoderms; shells. (Returned.) 4458 (VIII, VI).

WOODWARD, B. F., Sarcoxie, Missouri: Metal pipe. (Returned.) 4350 (XIV).

WORCESTER SOCIETY OF ANTIQUITY, Worcester, Massachusetts: Transmitted by Thomas A. Dickinson. Stone marked with hieroglyphics. (Returned.) 3945 (XIV).

WORSHAM, W. H., Station Camp, Tennessee: Ore. (Returned.) 4317 (XIII).

WORTH, J. G., Skinner, Colorado: Supposed asbestos. (Returned.) 4344 (XIII).

WORTHEN, C. K., Warsaw, Illinois: Mammal skins and skulls. 4214 (portion returned and remainder retained, 31869) (I).

WRIGHT, BERLIN H., Penn Yan, New York: Unios and shells from Georgia, Alabama, Virginia, and other parts of the United States. 3992 (portion returned and remainder retained, 31219); 4038 (portion returned and remainder retained, 31330); 4110 (portion returned and remainder retained, 31478); 4119 (portion returned and remainder retained, 31505); 4157 (portion returned and remainder retained, 31563); 4159 (portion returned and remainder retained, 31597); 4171 (returned); 4434 (portion returned and remainder retained, 32146) (VI).

WRIGHT, H. L., Granbury, Texas: Ore. (Returned.) 4204 (XIII).

WRIGHT, J. M., Wirmingham, Tennessee: Fossils; lower human jaw. 3916 (returned); 3999 (X–B, XIV).

WRIGHT, Dr. W. S., Brown, Colorado: Ore. (Returned.) 3806 (XIII).

WYANT, J. H., Hinton, West Virginia: Piece of metal. (Returned.) 4289 (XIII).

YOUNG, J. P., Ithaca, New York: Two stone implements. (Returned.) 4095 (XIV).

YOUNG, W. H. (See under Plant City Supply Co.)

YOUNG, Mrs., Washington, D. C.: Supposed meteorite. (Returned.) 4199 (XII).

YOUNG NATURALISTS' SOCIETY, Seattle, Washington, transmitted by Dr. J. B. White: Stone image from San Juan Island. (Returned.) 3930 (XIV).

YOUNT, S. E., Sandy, Nevada: Stones. (Returned.) 3981 (XIII).

ZINN, J. H., Gettysburg, Pennsylvania: Mineral. (Returned.) 4489 (XII).

Index to list of specimens sent for examination and report, arranged geographically.

Source.	No. of lots.
North America:	
British America	3896, 3972, 4040, 4113, 4125, 4181, 4287, 4432, 4442, 4443.
Central America	3794, 3820, 3893, 3923, 3955, 3977, 4061, 4162, 4474.
Mexico	4039, 4066, 4090, 4155, 4474.
United States—	
Alabama	3861, 3952, 4128, 4157, 4373, 4471.
Alaska	4085.
Arizona	3822, 3833, 3863, 3898, 3907, 3910, 3985, 4009, 4149, 4194, 4222, 4271, 4277, 4313, 4346, 4401.
Arkansas	3778, 3835, 3858, 3941, 4000, 4012, 4036, 4067, 4124, 4189, 4260, 4412, 4463.
California	3838, 3840, 3860, 3949, 3970, 3986, 3993, 4010, 4023, 4087, 4091, 4100, 4102, 4106, 4132, 4145, 4151, 4174, 4193, 4202, 4206, 4217, 4219, 4223, 4270, 4323, 4358, 4370, 4390, 4397, 4405, 4419, 4424, 4437, 4449.
Colorado	3806, 3834, 4037, 4050, 4086, 4107, 4131, 4152, 4167, 4278, 4279, 4285, 4305, 4315, 4333, 4344, 4352, 4389, 4439.
Connecticut	3936, 3980, 4216, 4445, 4446.
District of Columbia	3882, 3931, 3946, 3950, 4004, 4021, 4049, 4192, 4199, 4201, 4226, 4296, 4300, 4306, 4448.

Index to list of specimens sent for examination and report, etc.—Continued.

Source.	No. of lots.
North America—Continued.	
United States—	
Florida	3797, 3813, 3843, 3853, 3926, 3956, 3960, 3974, 3988, 4008, 4016, 4048, 4105, 4138, 4150, 4210, 4281, 4283, 4365, 4366, 4400, 4403, 4422.
Georgia	3793, 3823, 3921, 4013, 4119, 4159, 4231, 4288, 4483, 4490.
Idaho	3786, 3826, 4071, 4080, 4165, 4229, 4339, 4457.
Illinois	3829, 3939, 3883, 3886, 3891, 3902, 3934, 3948, 3978, 4031, 4034, 4041, 4070, 4073, 4093, 4103, 4200, 4208, 4214, 4245, 4246, 4261, 4297, 4346, 4360, 4388, 4426, 4466, 4479.
Indian Territory	3889, 4384, 4473.
Indiana	3821, 3877, 3990, 4096, 4129, 4130, 4164, 4241, 4254, 4340, 4354, 4355 4427, 4455, 4478.
Iowa	3779, 3799, 3814, 4024, 4028, 4082, 4183, 4299, 4377, 4395, 4487.
Kansas	3880, 3909, 3939, 3965, 4002, 4043, 4059, 4146, 4170, 4468.
Kentucky	3884, 3997, 4027, 4161, 4237, 4282, 4291, 4331, 4357, 4465.
Louisiana	3842, 3845, 3915, 3927, 3933, 4018, 4077, 4251, 4280, 4404, 4456.
Maine	3852, 4076, 4158.
Maryland	3837, 3846. 3890, 3968, 4046, 4060, 4062, 4185, 4205, 4301, 4310, 4332, 4409.
Massachusetts	3855, 3925, 3945, 3962, 4083, 4104, 4105, 4169, 4180, 4187, 4253, 4294, 4322, 4328, 4391, 4408, 4447.
Michigan	3796, 3809, 3827, 3828, 3841, 3856, 3901, 3962, 4003, 4047, 4089, 4345, 4369, 4396, 4453.
Minnesota	3789, 3800, 4026, 4116, 4117, 4259, 4324, 4348.
Mississippi	3849, 3964.
Missouri	3781, 3815, 3830, 3831, 3875. 3887, 3895, 3913, 3920, 3938, 4054, 4088, 4148, 4177, 4298, 4350, 4431, 4435, 4472, 4484.
Montana	3844, 3854, 3914, 4121, 4133, 4156, 4182, 4250, 4295, 4335, 4343, 4462,
Nebraska	3793, 3804, 4135, 4142, 4185, 4433.
Nevada	3981.
New Jersey	3832, 4007, 4098, 4220, 4476.
New Mexico	3851, 3979, 3998, 4055, 4190, 4224, 4233, 4413, 4414, 4454.
New York	3801, 3810, 3817, 3848, 3850, 3864, 3875, 3879, 3903, 3991, 4001, 4014, 4018, 4022, 4035, 4038, 4058, 4078, 4095, 4097, 4108, 4109, 4110, 4111, 4126, 4163, 4171, 4209, 4212, 4227, 4242, 4248, 4258, 4264 4268, 4292, 4320, 4372, 4379, 4383, 4402, 4420, 4421, 4434 4441, 4469.
North Carolina	3780, 3791, 3876, 3887, 3918, 3989, 4056, 4114, 4191, 4330, 4351, 4359, 4407.
North Dakota	4195.
Ohio	3825, 3836, 3954, 3966, 4020, 4044, 4052, 4072, 4123, 4155, 4168, 4238, 4257, 4302, 4311, 4342, 4363, 4382, 4440, 4461, 4470.
Oklahoma	3824, 4025, 4068, 4134, 4136.
Oregon	3792, 3862, 3872, 3952, 3975, 4032, 4057, 4166, 4211, 4218, 4221, 4243, 4275, 4294, 4312, 4334, 4336, 4417, 4428, 4444, 4493.
Pennsylvania	3798, 3807, 3819, 3859, 3899, 3912, 3919, 3937, 3942, 3943, 3944, 3947, 4015, 4033, 4053, 4074, 4094, 4137, 4184, 4273, 4308, 4321, 4367, 4375, 4378, 4393, 4429, 4458, 4489.
Rhode Island	3870, 3984, 4042, 4115, 4143, 4207, 4232, 4286, 4329, 4356.
South Carolina	3805, 3894, 4030, 4045, 4213, 4266, 4307, 4327, 4353, 4386, 4392, 4425, 4459, 4460.
South Dakota	3795, 4154, 4235, 4361, 4481.
Tennessee	3787, 3909, 3868, 3869, 3874, 3881, 3916, 3999, 4017, 4063, 4198, 4256, 4311, 4317, 4402, 4406, 4450, 4475.

Index to list of specimens sent for examination and report, etc.—Continued.

Source.	No. of lots.
North America—Continued.	
United States—	
Texas	3788, 3811, 3865, 3911, 3957, 3963, 3987, 3994, 3995, 4084, 4122, 4153, 4179, 4197, 4203, 4204, 4252, 4267, 4376, 4380, 4467, 4480, 4482, 4488.
Utah	3812, 3866, 3871, 3878, 3885, 3892, 3958, 3976, 4160, 4247, 4274, 4341, 4368, 4371, 4381, 4415, 4486.
Vermont	4099, 4318.
Virginia	3790, 3803, 3847, 3873, 3887, 3897, 3900, 3905, 3940, 3983, 4029, 4075, 4101, 4120, 4157, 4193, 4263, 4284, 4290, 4325, 4347, 4364, 4394, 4398, 4411, 4452, 4485.
Washington	3784, 3818, 3930, 3951, 3961, 3922, 3969, 3971, 4019, 4140, 4141, 4173, 4176, 4188, 4225, 4228, 4319, 4349, 4385, 4410, 4416, 4423, 4436, 4436, 4491, 4492.
West Virginia	3908, 3959, 4005, 4029, 4069, 4118, 4139, 4144, 4147, 4215, 4234, 4255, 4265, 4272, 4276, 4289, 4337, 4418.
Wisconsin	3782, 3888, 3904, 3935, 3967, 3973, 4112, 4178, 4244, 4249, 4299, 4314, 4338, 4451.
Wyoming	3802, 3929, 4065, 4175, 4230, 4239, 4276.
West Indies	3808, 4064, 4127, 4240, 4326.
South America	3977, 3982, 4399, 4464.
Europe	3816, 4006, 4011, 4064, 4079, 4092, 4262, 4309, 4374, 4387, 4418.
Asia	4303, 4304, 4430.
Africa	3906, 4477.
Oceanica	3917, 3932, 4081, 4172, 4269.

Number of lots of specimens referred to the departments in the Museum for examination and report.

Department.	Number of lots.
Mammals	13
Birds	96
Birds' eggs	3
Reptiles and batrachians	7
Fishes	8
Mollusks	82
Insects	70
Marine invertebrates	13
Helminthology	4
Comparative anatomy	9
Paleontology	22
Botany	57
Minerals	96
Geology	179
Prehistoric anthropology	51
Ethnology	1
Oriental antiquities	5
Arts and industries	25

APPENDIX VII.

LECTURES AND MEETINGS OF SOCIETIES.

PAPERS READ AT THE NINTH ANNUAL MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA.

I. The different kinds of earth-crust movements and their causes. Joseph Le Conte.

II. Crater lake. J. S. Diller.

III. The Leucite hills, Wyoming. J. F. Kemp.

IV. Physiographic development of the District of Columbia region. N. H. Darton.

V. Dikes in Appalachian Virginia. N. H. Darton.

VI. On the changes of drainage in the Ohio river basin. Frank Leverett.

VII. The solution of quartz under atmospheric conditions. C. Willard Hayes.

VIII. Erosion at base-level. Marius R. Campbell.

IX. The origin of certain topographic forms. Marius R. Campbell.

X. Homology of joints and artificial fractures. J. B. Woodworth.

XI. Notes on the structure of the Cranberry district in North Carolina. Arthur Keith.

XII. Notes on the stratigraphy of certain homogeneous rocks. C. H. Hitchcock.

XIII. Unconformities in Marthas Vineyard and Block Island. J. B. Woodworth.

XIV. Evidences of northeasterly differential rising of the land along Bell river. Robert Bell.

XV. Surface tension of water as a cause of geological phenomena. George E. Ladd.

XVI. Cementing materials of the Tertiary sands and gravels of western Kansas. Erasmus Haworth.

XVII. The work of the United States Geological Survey in the Sierra Nevada. H. W. Turner.

XVIII. Geomorphy of Jamaica as evidence of changes of level. J. W. Spencer.

XIX. The Cornell glacier, Greenland. Ralph S. Tarr.

XX. Shore lines of Lake Warren and of a lower water level in western central New York. H. L. Fairchild.

XXI. Old tracks of Erian drainage in western New York. G. K. Gilbert.

XXII. The assumed glaciation of the Atlas mountains of Africa. Angelo Heilprin.

XXIII. The relation of an abandoned river channel in eastern Iowa to the western edge of the Illinois ice-lobe. Frank Leverett.

XXIV. Glacial observations in the Umanak district, Greenland. George H. Barton.

XXV. The Nipissing-Matawa river, the outlet of the Nipissing great lakes. F. B. Taylor.

XXVI. Moraines of recession and their significance in glacial theory. F. B. Taylor.

XXVII. Mechanics of glaciers-moraines and stratification. Harry Fielding Reid.

XXVIII. Variations of glaciers. Harry Fielding Reid.

XXIX. Preliminary note on the Pleistocene history of Puget sound. Bailey Willis.

XXX. Modified drift in St. Paul, Minnesota. Upham Warren.

XXXI. Note on plasticity of glacial ice. I. C. Russell.

XXXII. Physical basis for general geological correlation. Charles R. Keyes.

XXXIII. Origin and relations of the Greenville-Hastings series in the Canadian Laurentian (with observations by R. W. Ellis). F. D. Adams and A. E. Barlow.

XXXIV. The pre-Cambrian topography of the eastern Adirondacks. J: F. Kemp.

XXXV. The age of the white limestone of Sussex county, New Jersey. J. E. Wolff and A. H. Brooks.

XXXVI. Notes on the Potsdam and Lower Magnesian formations of Wisconsin and Minnesota. Joseph F. James.

XXXVII. On the southern Devonian formations. Henry S. Williams.

XXXVIII. A complete oil-well record in the McDonald field between the Pittsburg coal and the Fifth Oil Sand. I. C. White.

XXXIX. The age of the lower coals of Henry county, Missouri. David White.

XL. Structure of the Newark formation of western New Jersey. Henry B. Kümmel.

XLI. The Upper Cretaceous formation of the northern Atlantic coastal plain. William B. Clark.

XLII. Notes on the stratigraphy and Paleontology of the Laramie and related formations in Wyoming. T. W. Stanton and F. H. Knowlton.

XLIII. Geology of northwestern Washington. I. C. Russell.

XLIV. A study of the nature, structure, and phylogeny of *Dæmonelix*. E. H. Barbour.

XLV. Notes on rock weathering. George P. Merrill.

XLVI. New evidence on the origin of some trap sheets of New Jersey. Henry B. Kümmel.

XLVII. The crystalline and metamorphic rocks of northwest Georgia. C. Willard Hayes and Alfred H. Brooks.

XLVIII. The grain of rocks. Alfred C. Lane.

XLIX. The origin and age of the gypsum deposits of Kansas. G. Perry Grimsley.

PAPERS READ AT THE MEETING OF THE NATIONAL SCIENCE CLUB, APRIL 6-9, 1897.

Hydroids. Miss Minnie Stafford and Miss Buhannon.

Plant variation. Mrs. Emilia C. Anthony.

An object lesson in natural science. Miss W. A. Kellerman.

A voluntary observer. Mrs. L. M. McCauley.

Relation of woman to the science of being. Mrs. Elizabeth O. Sampson Hoyt.

Fossils of Chicago and vicinity. Mrs. Ada D. Davidson.

Winter buds. Miss Rebecca Wayne Knight.

Flora of Buffalo, N. Y. Miss Edna Porter.

The environment of plants. Mrs. M. M. Boyce.

Sociology. Mrs. C. Bonnell.

Study of child life. Mrs. Florence Floyd.

Economic government. Mrs. Mary I. Barnes.

Physical science. Mrs. Mary Newbury Adams.

Birds. Mrs. M. A. Booth.

Revision of *Adeorbis* and American marine mollusca erroneously referred to that genus. Katharine Jeannette Bush.

Mushrooms. Mrs. E. C. Anthony.

The way of climbing plants. Mrs. Mary E. Treat.

The conservative rôle of bacteria in nature. Miss Mary Forster.

The Morning Glory. (Morphology, histology, physiology.) Miss Mary E. Hart.

Leaf variation. Mrs. W. A. Kellerman.

Botanical collections of some American expeditions. Miss Ellen Weir Cathcart.

Mosses. Mrs. Elizabeth G. Britton.
Extracts from life of Linnaeus. Mrs. Lydia Diller Zell.
Astronomy. Miss M. F. Borst.
Structure of eye of *Limax maximus*. Miss Annie P. Henchman.
Jumping spiders. Mrs. Elizabeth G. Peckham.
The *Myrmeleon*. Mrs. Frances Rhees Burket.
Marble quarry. Miss Kate Carter.
Variation in leaves of *Quercus nigra*. Miss Jane Frances Winn.
Moths and butterflies, with observations on *Papilio asterias*. Mrs. Annabel Cook Whitcomb.
Entomology; a new Pyralid; autumn butterflies. Miss Mary E. Murtfeldt.
An undescribed *Psylla*. Miss Mary E. Hill.
A bit of family history. (*Membracis binotata.*) Miss Elizabeth G. Hughes.
The shells of New Jersey. Mrs. H. D. Mitchell.
Marine Algæ. Mrs. Cora H. Clarke.
Meteorology. Mrs. L. H. Grenewald.
Mount Blanc and the ice fields. Mrs. Ada D. Davidson.
Cupiliferæ; the oak family. Mrs. Emma J. Curtis.
Bird architecture. Miss Harriet Brown Bailey.
Other worlds than ours. (Illustrated by lantern slides.) Miss Mary Proctor.

PAPERS ENTERED TO BE READ AT THE MEETING OF THE NATIONAL ACADEMY OF SCIENCES, APRIL 20–23, 1897.

The influence of environment upon the biological processes of the various members of the Colon group of bacilli.—An experimental study. Adelaide Ward Peckham, M. D.
On the energy involved in recent earthquakes. T. C. Mendenhall.
On a ring pendulum for absolute determinations of gravity. T. C. Mendenhall and A. S. Kimball.
Biographical memoir of G. Brown Goode. S. P. Langley.
Biographical memoir of Thomas L. Casey. H. L. Abbott.
Biographical memoir of Charles E. Brown-Séquard. H. P. Bowditch.
Biographical memoir of Hubert A. Newton. J. W. Gibbs.
Biographical memoir of George H. Cook. G. K. Gilbert.
On the variation of latitude. S. C. Chandler.
The position of the Tarsiids and relationship to the phylogeny of man. Theodore Gill.
A new harmonic analyser. A. A. Michelson and S. W. Stratton.
Variation of latitude and constant of aberration from observations at Columbia University. J. K. Rees, H. Jacoby, and H. S. Davis.
On recent borings in coral reefs. A. Agassiz.
Notes of experiments upon the Röntgen rays. Arthur W. Wright.

TITLES OF THE SATURDAY LECTURES FOR 1897.

COURSE 1.—*Hydrography.*

March 13.—Rivers of the United States. F. H. Newell.
March 20.—Waterfalls of the United States. Marius R. Campbell.
March 27.—Niagara. G. K. Gilbert.

COURSE 2.—*Current topics.*

April 3.—The Eastern question. Benjamin Ide Wheeler.
April 10.—New light on alchemy. H. Carrington Bolton.
April 17.—Food adulterations. Harvey W. Wiley.
April 24.—Modern explosives. Charles E. Munroe.
May 1.—X-rays and their applications. E. A. de Schweinitz.

APPENDIX VIII.

Finance, Property, Supplies, and Accounts.

Appropriations and expenditures for the fiscal year ending June 30, 1897.

Object.	Appropriation.	Expenditures.	Balance on hand June 30, 1897.
Preservation of collections	$153, 225. 00	$149, 023. 07	$4, 201. 93
Furniture and fixtures	15, 000. 00	13, 198. 93	1, 801. 07
Heating, lighting, and electrical service	13, 000. 00	12, 257. 89	742. 11
Postage	500. 00	500. 00	....
Building repairs	4, 000. 00	3, 884. 75	115. 25
Rent of workshops	2, 000. 00	1, 999. 92	. 08
Galleries	8, 000. 00	3, 975. 65	4, 024. 35
Printing	12, 000. 00	11, 991. 67	8. 33
Total	207, 725. 00	196, 831. 88	10, 893. 12

Disbursements from unexpended balances of appropriations for the fiscal year ending June 30, 1896.

Object.	Balance, June 30, 1896.	Expenditures.	Balance, June 30, 1897.
Preservation of collections	$2, 846. 53	$2, 845. 21	$1. 32
Furniture and fixtures	1, 315. 09	1, 314. 89	. 20
Heating and lighting	947. 33	946. 91	. 42
Building repairs	929. 51	928. 13	1. 38
Rent of workshops	75. 00	75. 00	....
Total	6, 113. 46	6, 110. 14	3. 32

From the unexpended balance of the appropriation for the preservation of collections for the fiscal year ending June 30, 1895, disbursements to the amount of $36.19 were made, leaving a balance of $6.12, which will revert into the Treasury, to be carried to the credit of the surplus fund, under the provisions of section 3090 of the Revised Statutes.

APPENDIX IX.

STATEMENT OF THE DISTRIBUTION OF SPECIMENS DURING THE YEAR ENDING JUNE 30, 1897.

AFRICA.

Albany Museum, Grahamstown, South Africa: Bird skins (137 specimens). Exchange. (D. 10363.)

AMERICA.

NORTH AMERICA.

Canada.

BRITISH COLUMBIA: Keen, J. H., Massett, Queen Charlotte Island: Coleoptera (25 specimens). Exchange. (D. 10089.)

Provincial Museum, Victoria: Bird skins (11 specimens). Exchange. (D. 10586.)

ONTARIO: Brooks, W. E.: Bird skins (2 specimens). Lent for study. (D. 10355.)

Fleming, J. H., Toronto: Bird skins (7 specimens). Exchange. (D. 10226.)

Fowler, James, Kingston: Botanical material (493 specimens). Exchange. (D. 10647.)

Geological Survey of Canada, Ottawa: Corals (20 specimens). Lent for study. (D. 10270.)

Macoun, J. M., Ottawa: Skeleton of sea otter. Exchange. (D. 10869.)

QUEBEC: Peter Redpath Museum, Montreal: Geological material (14 specimens). Exchange. (D. 10898.)

Mexico.

National Medical Institute of Mexico: Botanical material (220 specimens). Exchange. (D. 10631.)

United States.

ALABAMA: Union Female College, Eufaula: Minerals (57 specimens, set 190). Gift. (D. 10294.)

ARIZONA: Agricultural Experiment Station, Tucson: Botanical material (157 specimens). Exchange. (D. 10610.)

CALIFORNIA: Bowers, Stephen, Los Angeles: Minerals (12 specimens). Exchange. (D. 10928.)

Brandegee, T. S., San Diego: Plants (4 specimens). Lent for study. (D. 10468.)

California Academy of Sciences, San Francisco: Bird skins (9 specimens). Lent for study. (D. 10152.)

Daggett, John, San Francisco: Casts of parts of lay figure; cast of head and feet of California infant. Exchange. (D. 10462, 10706.)

Fenyea, A., Pasadena: Coleoptera (1,150 specimens). Exchange. (D. 10853.)

Gilbert, C. H., Stanford University: Fishes (7 specimens). Lent for study. Three specimens of fish, in exchange. (D. 10815, 10883.)

Grinnell, Joseph, Pasadena: Bird skins (75 specimens). Lent for study. (D. 10909.)

Hemphill, Henry, San Diego: Shells (6 specimens). Exchange. (D. 10461.)

Leland Stanford Junior University, Stanford University: Sharks (5 specimens). Lent for study. Botanical material (425 specimens). Exchange. (D. 10244, 10646.)

Oldroyd, Mrs. T. S., Los Angeles: Specimen of *Pentacrinus decorus*. Exchange. (D. 10927.)

Parish, Samuel B., San Bernardino: Botanical material (109 specimens). Exchange. (D. 10636.)

COLORADO: Crandall, C. S., Fort Collins: Botanical material (179 specimens). Exchange. (D. 10645.)

State Normal School, Greeley: Rocks and ores (99 specimens, set 70). Gift. (D. 10167.)

CONNECTICUT: Eames, E. A., Bridgeport: Plants (829 specimens). Exchange. (D. 11012.)

Richards, William C., Bristol: Pueblo objects (9 specimens). Exchange. (D. 10376.)

Van Deusen, R. T., Hartford: Two china plates. Exchange. (D. 10529.)

Wesleyan University, Middletown: Pueblo pottery (16 specimens). Exchange. (D. 11061.)

Yale College, New Haven: Shells (6 specimens). Lent for study. Casts of fossils (3 specimens). Exchange. (D. 10459, 10688.)

DELAWARE: Canby, William M., Wilmington: Plants (15 specimens). Exchange. (D. 10974.)

Delaware College, Newark: Marine invertebrates (460 specimens, set 45, Series V). Gift. (D. 10613.)

Natural History Society of Wilmington, Wilmington: Unmounted plants (67 specimens). Exchange. (D. 10615.)

DISTRICT OF COLUMBIA: Benedict, J. E., jr., Washington. Arrowheads (15 specimens). Exchange. (D. 10735.)

Catholic University of America, Washington: Rocks and ores (102 specimens, set 64). Exchange. Plants (16 specimens). Gift. (D. 10274, 10992.)

Central High School, Washington: Bird skins (6 specimens). Exchange. (D. 10436.)

Holm, Theodor, Brookland: Plants (9 specimens). Lent for study. (D. 11060.)

Howell, E. E., Washington: Rocks and ores; Indian vessel from New Mexico. Exchange. (D. 11016, 11038.)

Knowlton, F. H., Washington: Bird skins (59 specimens). Exchange. (D. 11058.)

Lucy Webb Hayes National Training School, Washington: Rocks and ores (98 specimens, set 72). Gift. (D. 10591.)

Nelson, E. W., Department of Agriculture: Skins and skulls of shrews (12 specimens). Lent for study. (D. 10352.)

Sayers, Mrs. Joseph D., Washington: Basketry and pottery (13 specimens). Exchange. (D. 10831.)

DISTRICT OF COLUMBIA—Continued.

Stevens, Mrs. Alice F., Washington: Plants (80 specimens). Exchange. (D. 10986.)

Topping, D. LeRoy, Washington: Botanical material (95 specimens). Exchange. (D. 10641.)

U. S. Botanical Garden, Washington: 100 bulbs for planting. (D. 10240.)

Washington Normal School, Washington: Mounted mammal. Gift. (D. 10793.)

FLORIDA: Curtis, A. H., Jacksonville: Botanical material (540 specimens). Exchange. (D. 10637.)

Hopkins, S., Melbourne Beach: Mounted plants (2 specimens). Lent for study. (D. 10154.)

GEORGIA: Shaver, H., Augusta: Polished stone hatchet. Exchange. (D. 10403.)

Spellman Seminary, Atlanta: Starfishes and sea-urchins (30 specimens). Gift. (D. 10111.)

ILLINOIS: Cockerton, Frank T., Danville, Ammonites (2 specimens); fossils (29 specimens); fossil fish. Exchange. (D. 10450, 10599, 10841.)

Field Columbian Museum, Chicago: Geological material (22 specimens); crustaceans (101 specimens and 2 vials); botanical material (366 specimens.) Exchange. Plants (28 specimens). Lent for study. (D. 11026, 10493, 10642, 10984.)

High School, Springfield: Marine invertebrates (336 specimens, set 95, Series V). Gift. (D. 10750.)

Holmes, S. J., Chicago: Specimen of *Eupagurus mertensi*. Exchange. (D. 10361.)

McMurry, Mrs. Lida B., Normal: Wampum beads. Exchange. (D. 10539.)

Moffatt, W. S., Wheaton: Botanical material (130 specimens). Exchange. (D. 10644.)

University of Chicago, Chicago: Plants (122 specimens). Gift. (D. 10971.)

INDIANA: Arthur, J. C., Lafayette: Plants (4 specimens). Exchange. (D. 10768.)

High School, Evansville: Rocks and ores (103 specimens, set 55). Gift. (D. 10901.)

INDIANA—Continued.

Indiana Institute for the Blind, Indianapolis: Marine invertebrates (102 specimens). Gift. (D. 10668.)

Wright, John S., Indianapolis: Herbarium material (4 specimens). Lent for study. (D. 11032.)

IOWA: Agricultural College, Ames: Botanical material (200 specimens). Exchange. (D. 10639.)

American Archæological and Asiatic Association, Nevada: Casts of stone implements (2 specimens). Gift. (D. 10326.)

Atlantic Normal School, Atlantic: Bird skins (115 specimens). Gift. (D. 10763.)

Crocker School, Des Moines: Rocks and ores (103 specimens, set 56). Gift. (D. 10890.)

High School, Garner: Rocks and ores (103 specimens). Gift. (D. 10961.)

High School, Inwood: Rocks and ores (103 specimens, set 52). Gift. (D. 11059).

High School, Marion: Rocks and ores (102 specimens, set 63). Gift. (D. 10183.)

Sac City Institute, Sac City: Rocks and ores (99 specimens, set 69). Gift. (D. 10446.)

State University of Iowa, Iowa City: Mounted slides of Plumularidæ. Lent for study. (D. 10601.)

Storm Lake Public Schools, Storm Lake: Rocks and ores (102 specimens, set 65). Gift. (D. 10286.)

Upper Iowa University, Fayette: Mounted mammals (22 specimens); stuffed fishes (2 specimens). Gift. (D. 10112.)

KENTUCKY: Garman, H., Lexington: Insects (138 specimens). Lent for study. (D. 10749.)

LOUISIANA: Louisiana Industrial Institute, Ruston: Marine invertebrates (332 specimens, set 95, Series V). Gift. (D. 11102.)

MAINE: Morton, F. S., Portland: Foraminifera (26 vials). Exchange. (D. 10830.)

MARYLAND: Peabody Institute, Baltimore: Fossil cycads (2 specimens). Lent for study. (D. 10059.)

MARYLAND—Continued.

Smith, J. Donnell, Baltimore: Plants (12 specimens); seven unmounted photographs. Exchange. Plants (3 specimens). Lent for study. Botanical material (591 specimens). Exchange. (D. 10596, 10642.)

Woman's College, Baltimore: Pueblo pottery (20 specimens). Exchange (D. 10650.)

MASSACHUSETTS: Amherst College, Amherst: Pterophoridæ (127 specimens). Lent for study. (D. 10315.)

Botanic Gardens, Cambridge: Botanical material (899 specimens). Exchange. (D. 10632.)

Brewster, William, Cambridge: Bird skins (8 specimens). Lent for study. (D. 10343, 10344.)

City Library Association, Springfield: Stone implements, arrowheads, etc. (69 specimens). Gift. (D. 10067.)

Cory, Charles B., Hyannis: Bird skins (18 specimens). Lent for study. (D. 11050, 10335.)

Davenport, George E., Medford: Mounted plant. Lent for study. (D. 10958.)

Deane, Walter, Cambridge: Botanical specimen. Exchange. (D. 10751.)

Eastman, C. R., Cambridge: Skull of fossil skate. Lent for study. (D. 10628.)

Farlow, W. G., Cambridge: Fungi (10 specimens). Exchange. (D. 10982.)

Faxon, C. E., Jamaica Plains: Mexican plants (9 specimens). Lent for study. (D. 10163.)

Gray Herbarium, Cambridge: Four photographs of plants; unmounted plants (61 specimens). Exchange. (D. 10515, 10616.)

Greenman, J. M., Cambridge: Plants (5 specimens). Lent for study. (D. 10960.)

Gurley, R. R., Worcester: Niagara graptolites (5 specimens). Lent for study. (D. 10594.)

Harvard College, Cambridge: Specimen of *Commelina hirtella*. Gift. (D. 10191.)

Hyatt, Alpheus, Cambridge: Fossils (51 specimens, 13 species); fossils (6 specimens); Cretaceous ammonites (23 specimens). Lent for study. (D. 10167, 10714, 10895.)

MASSACHUSETTS—Continued.

Lowell City Library, Lowell: Rocks and ores (103 specimens, set 61). Gift. (D. 10796.)

Normal Training School, Holyoke: Rocks and ores (103 specimens, set 58). Gift. (D. 10813.)

Robinson, B. L., Cambridge: Mounted herbarium material (25 specimens). Exchange. Mounted plants (5 specimens). For examination. (D. 10205, 10397.)

Wellesley College, Wellesley: Lichens (25 specimens). Exchange. (D. 10309.)

Woodworth, W. McM., Cambridge: Living worms; two vials of Planarians; marine invertebrates. Lent for study. (D. 10775, 10776, 10804.)

Woodworth, W. W., Cambridge: Marine invertebrates. Lent for study. (D. 10712, 10713.)

MICHIGAN: Alma College, Alma: Rocks and ores (102 specimens, set 67). Gift. (D. 10723.)

Kent Scientific Institute, Grand Rapids: Bird skins (3 specimens). Exchange. (D. 10209.)

MINNESOTA: University of Minnesota, Minneapolis: Fossil plants (43 specimens). Exchange. (D. 10854.)

MISSOURI: Glatfelter, N. M., St. Louis: Botanical material (7 specimens). Lent for study. (D. 10702.)

Greger, K., Fulton: Fossil brachiopods (64 specimens). Exchange. (D. 10256.)

Kane, W. G., Kansas City: Specimens of barite, fluorite, and other minerals. Exchange. (D. 10252, 10325.)

Latterman, George W., Allentown: Botanical material (252 specimens). Exchange. (D. 10635.)

Missouri Botanic Garden, St. Louis: Specimen of *Commelina hirtella*. Gift. (D. 10192.)

Pilot Grove Academy, Pilot Grove: Rocks and ores (99 specimens, set 71). Gift. (D. 10492.)

School of Mines of the University of Missouri, Rolla: Collection of ooze and foraminifera. Gift. (D. 10375.)

NEBRASKA: Fremont Normal School, Fremont: Rocks and ores (102 specimens, set 62). Gift. (D. 10782.)

NEBRASKA—Continued.

Normal School, Wayne: Rocks and ores (103 specimens, set 57). Gift. (D. 10851.)

York College, York: Rocks and ores (98 specimens, set 73); casts of stone implements (106 specimens, set 57). Gift. (D. 10120.)

NEW JERSEY: Public Schools, Weehawken: Botanical material (397 specimens). Exchange. (D. 10638.)

Smith, John B., New Brunswick: *Acronycta* (899 specimens); microscopic slides of *Acronycta;* noctuids (83 specimens). Lent for study. (D. 10271, 10384, 10801.)

Stevens Institute of Technology, Hoboken: Model of the Stevens twin-screw steamboat. Gift. (D. 10619.)

NEW YORK: Allen, J. A., New York: Small mammals (11 specimens); skins and skulls of mammals (17 specimens). Lent for study. (D. 10507, 10549, 10689.)

American Museum of Natural History. New York: Cast of brook trout. Exchange. Bird skins (9 specimens). Lent for study. (D. 10419, 10439.)

Boys' High School, Brooklyn: Specimen of Crinoid. Gift. (D. 10538.)

Chapman, Frank M., New York: Bird skins (19 specimens). Lent for study. (D. 11027.)

Brown, Mrs. J. Crosby, New York: One musical instrument. Exchange. (D. 10599.)

Columbia University, New York: Herbarium material (8 specimens). Lent for study. Botanical material (960 specimens); alcoholic fishes (6 specimens); plants (19 specimens). Exchange. Trilobites (4 specimens). Gift. (D. 10083, 10633, 10649, 10993, 11013.)

Cornell University, Ithaca: Herbarium material (3 specimens). Lent for study. (D. 10105.)

English, George L., & Co., New York: Minerals (2 specimens). Exchange. (D. 10338.)

Glen Island Museum, Glen Island: Thirteen photographs. Lent for study. Cast of *Mesoplodon bidens.* Exchange. (D. 10502, 10588.)

New York—Continued.

Herbarium of Columbia College, New York: Herbarium material (98 specimens). Lent for study. (D. 10072.)

Normal College, New York: Mounted plants (222 specimens). Lent for study. (D. 10234.)

Ralph, William L., Utica: Birds' eggs. Exchange. (D. 10394.)

Rusby, H., New York: Botanical material. Lent for study. (D. 10660.)

Rydberg, P. A., Columbia University, New York: Herbarium material (10 specimens); mounted plants (10 specimens). Lent for study. (D. 10291, 10618.)

Small, John K., New York: Plants (2 specimens). Exchange. (D. 10737.)

Snyder, F. D., Gaines: Star-fishes and ophiurans (9 specimens). Exchange. (D. 10505.)

University of the City of New York, New York: Rocks and ores (104 specimens, set 10). Gift. (D. 10362.)

Ward's Natural Science Establishment, Rochester: Geological material (166 pounds). Exchange. (D. 10425.)

Wibbe, J. H., Schenectedy: Unmounted plants (49 specimens); botanical material (50 specimens); plants (70 specimens). Exchange. (D. 10617, 10682, 10975.)

Wright, Berlin H., Penn Yan: Unios (2 specimens). Exchange. (D. 10299.)

North Carolina: Wake Forest College, Wake Forest: Rocks and ores (103 specimens, set 60). Gift. (D. 10795.)

Ohio: Case, H. B., Loudonville: Fossils (5 specimens). Exchange. (D. 10411.)

Central Ohio Scientific Association, Urbana: Rocks and ores (103 specimens, set 54). Gift. (D. 10926.)

Ohio State University, Columbus: Dragon flies (32 specimens). Lent for study. (D. 10351.)

Oregon: Howell, Thomas, Clackamas: Plant. Exchange. (D. 10546.)

Pennsylvania: Academy of Natural Sciences, Philadelphia: Plant. Exchange. (D. 10738.)

Allen, Harrison, Philadelphia: Mammals (2 specimens). Lent for study. (D. 10518.)

Pennsylvania—Continued.

Atwater, W. O., Wilkesbarre: Charts illustrating foods. Lent for study. (D. 10629.)

Bryant, Henry G., Philadelphia: Alaskan ethnological material (19 specimens). Exchange. (D. 10935.)

Bryn Mawr College, Bryn Mawr: Geological material (10 specimens). Exchange. (D. 10891.)

Bucks County Historical Society, Doylestown: Casts of prehistoric stone implements (105 specimens, set 57). Gift. (D. 10677.)

Central Pennsylvania College, New Berlin: Marine invertebrates (464 specimens, set 43, Series V). Gift. (D. 10435.)

Culin, Stewart, Philadelphia: Collection of games. Lent for study. (D. 10781.)

Hart, Charles Henry, Rosemont: Photograph of portrait of General Jackson. Exchange. (D. 10732.)

Johnson, J. R., Pittsburg: Two casts of stone implements. Exchange. (D. 10187.)

Lehman, W. V., Fremont: Recent shells (43 specimens). Exchange. (D. 11011.)

Moore, J. Percy, Philadelphia: Collection of leeches. Lent for study. (D. 10598, 10894.)

Pilsbry, H. A., Philadelphia: Shells (94 specimens). Lent for study. (D. 10626.)

Pollock, Moses, Philadelphia: Facsimile of the Jefferson Bible. Exchange. (D. 10150.)

Randall, F. A., Warren: Phyllopods (4 specimens). Exchange. (D. 10691.)

Rhoads, S. N., Philadelphia: Mammals (46 specimens). Lent for study. (D. 10058, 10907, 10991.)

Sheppard, Edwin, Philadelphia: Bird skins (11 specimens). Lent for study. (D. 10630.)

Stone, Witmer, Philadelphia: Bird skins (70 specimens). Lent for study. (D. 10354, 10705, 10627.)

Thomson, Frank, Philadelphia: Cast of salmon. Exchange. (D. 10225.)

University of Pennsylvania, Philadelphia: Specimen of *Commelina hirtella*. Gift. (D. 10190.)

SOUTH CAROLINA: Wayne, Arthur T., Mount Pleasant: Bird skins (6 specimens). Exchange. (D. 10995.)

SOUTH DAKOTA: Yankton College, Yankton: Marine invertebrates (460 specimens, set 44, Series V). Gift. (D. 10466.)

TENNESSEE: Roane College, Wheat: Rocks and ores (103 specimens, set 59). Gift. (D. 10814.)

UTAH: All Hallows College, Salt Lake City: Minerals (26 specimens). Exchange. (D. 10731.)

Deseret Museum, Salt Lake City: Geological material (15 specimens); fossils (414 specimens). Exchange. (D. 10062, 10266.)

Jones, Marcus E., Salt Lake City: Botanical material (120 specimens). Exchange. (D. 10679.)

VERMONT: Bridgewater College, Bridgewater: Rocks and ores (102 specimens). Gift. (D. 10312.)

Pringle, C. G., Charlotte: Plants (8 specimens). Lent for study. (D. 10994.)

VIRGINIA: Fontaine, William M., Charlottesville: Fossil plants. Lent for study. (D. 10811.)

Fredericksburg College, Fredericksburg: Rocks and ores (101 specimens, set 68). Gift. (D. 10681.)

Norfolk College, Norfolk: Invertebrates (42 specimens). Gift. (D. 10531.)

WISCONSIN: High School, Janesville: Marine invertebrates (336 specimens, set 94, Series V). Gift. (D. 10424.)

High School, Sparta: Marine invertebrates (392 specimens, set 56, Series V). Gift. (D. 10548.)

WYOMING: Agricultural Experiment Station, Laramie: Botanical material (743 specimens). Exchange. (D. 10634.)

Sherman, C. A., Manville: Scraper handle. Exchange. (D. 10785.)

University of Wyoming, Laramie: Paleozoic fossils (175 specimens). Exchange. (D. 10852.)

CENTRAL AMERICA.

Costa Rica.

Instituto Fisico-geografico Nacional, San Jose: Botanical material (77 specimens). Exchange. (D. 10655.)

SOUTH AMERICA.

Brazil.

Museu Paulista, São Paulo: Fresh-water and marine shells (25 specimens). Exchange. (D. 10053.)

ASIA.

China.

Wilder, George D., Pekin: Bird skins (88 specimens). Exchange. (D. 10825.)

EUROPE.

Austria.

Friese, H., Innsbruck: Hymenoptera (352 specimens). Exchange. (D. 10931.)

Independent Association of Tyrolese Botanists, Karnten: Collection of lichens, mosses, and ferns. Exchange. (D. 10138.)

Tschusi zu Schmidhoffen, Victor Ritter von, Halle: Bird skins (17 specimens). Exchange. (D. 10224.)

Denmark.

Zoological Museum, Copenhagen: Crustaceans (72 specimens). Exchange. Six lots of crustaceans. Lent for study. (D. 10957.)

France.

Lassimonne, S. E., Moulins, Allier. Botanical material (456 specimens). Exchange. (D. 10654.)

Museum of Natural History, Paris: Crabs (139 specimens); fossils (71 specimens). Exchange. (D. 11062, 10267.)

Newmann, G., Toulouse: Insects. Lent for study. (D. 10791.)

Germany.

Zoological Museum, Berlin: Bat skin. Exchange. (D. 10126.)

Botanical Gardens, Dresden: Plants (8 specimens). Exchange. (D. 10724.)

Botanical Museum, Berlin: Botanical material (697 specimens). Exchange. (D. 10652.)

Königliche Museum für Naturkunde, Berlin: Crabs (103 specimens). Exchange. (D. 10748.)

Krauss, Alfred, Zittau, Saxony: Minerals (75 specimens); fossils (89 specimens). Exchange. (D. 10422.)

Paleontological Institute, Leipsic: Fossils (509 specimens). Exchange. (D. 10282.)

Zoological Institute, Kiel: Fishes, holothurians and crabs (33 specimens). Exchange. (D. 10648.)

Great Britain.

Baker, E. G., London: Plants (29 specimens). Lent for study. (D. 10930.)

British Museum, London: Botanical material (798 specimens). Exchange. (D. 10653.)

Hind, Wheelton, Stoke-upon-Trent: Fossil pelecypods (108 specimens.) Exchange. (D. 10266.)

Magdalene College, Cambridge: Bird skins (2 specimens). Lent for study. (D. 10153.)

Newton, Alfred, Cambridge: Bird skin. Lent for study. (D. 10293.)

Royal Botanical Garden, Kew: Herbarium material (43 specimens). Lent for study. Herbarium material (853 specimens; 8 photographs). Exchange. (D. 10078, 10658, 10690, 10771.)

Salvin, Osbert, London: Bird skins (4 specimens). Lent for study. (D. 10816.)

University Museum, Oxford: Casts of *Heloderma* and *Teguixin*. Exchange. (D. 10082.)

Kelingrove Museum, Glasgow: Stone implements (19 specimens); shell beads; rattlesnake, and skull of bison. Exchange. (D. 10151.)

Italy.

Colini, G. A., Rome: Throwing-stick and arrow point. Exchange. (D. 10917.)

Comes, O., Portici: Specimen of *Nicotiana*. Lent for study. (D. 10073.)

Garbini, Adriano, Verona: *Palæmonetes antrorum* (4 specimens). For study. (D. 10833.)

Museo Civico di Storia Naturale, Genoa: Alcoholic fishes (26 specimens). Exchange. (D. 10506.)

Royal Zoological Museum, Florence: Anthropological and ethnological material (56 specimens). Exchange. (D. 10207.)

Russia.

Royal Botanical Gardens, St. Petersburg: Botanical material (633 specimens). Exchange. (D. 10656.)

Spain.

Royal Academy of Science and Arts, Barcelona: Land and fresh-water shells (117 specimens); fossils (17 specimens). Exchange. (D. 10460.)

Switzerland.

Botanic Gardens and Museum, Zurich: Botanical material (303 specimens). Exchange. (D. 10657.)

Candolle, M. Casimir de, Geneva: Botanical material (355 specimens). Exchange. (D. 10659.)

Turkey.

The Sultan of Turkey, Constantinople: Lay figure of a Sioux chief and a trophy covered with silk trappings. (D. 10483.)

OCEANICA.

Australia.

New South Wales: Australian Museum, Sydney: Gobioid and blennioid fishes (39 specimens). Exchange. (D. 10904.)

New Zealand.

Farquhar, H., Wellington: Star-fish. Exchange. (D. 10098.)

PART II.

PAPERS DESCRIBING AND ILLUSTRATING COLLECTIONS IN THE U. S. NATIONAL MUSEUM.

RECENT FORAMINIFERA.

A DESCRIPTIVE CATALOGUE OF SPECIMENS DREDGED BY THE U. S. FISH COMMISSION STEAMER ALBATROSS.

BY

JAMES M. FLINT, M. D., U. S. N.,
Honorary Curator, Division of Medicine, U. S. National Museum.

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PREFACE.

The purpose of this catalogue is to record the results of an examination of a portion of the bottom material obtained during the dredging operations of the U. S. Fish Commission steamer *Albatross*, and at the same time to furnish a convenient book of reference for those who are, or may become, sufficiently interested to continue the study of this material.

The examination, while very far from exhaustive, has been pursued with greater or less diligence, as time and opportunity offered, for several years. Material from about one hundred and twenty-five stations has been carefully studied, and specimens from more than a hundred localities have been preserved and identified. Of these localities, fifty-eight are in the North Atlantic Ocean, twenty-one in the Gulf of Mexico, seven in the Caribbean Sea, one in the South Pacific, and five in the North Pacific. The depths at these stations vary from 7 to 2,512 fathoms.

The figures in illustration are from photographs of mounted specimens on exhibition in the U. S. National Museum, Division of Marine Invertebrates. A uniform enlargement of about 15 diameters has been maintained in the figures, sometimes at a sacrifice of detail in the smaller specimens which would have been made clearer by the use of a higher magnifying power, but for the purpose of identification it is believed to be more useful to mark distinctly the relative size of the objects. The exhibition series has been mounted expressly for public display. The individuals of each species are attached in various attitudes to the bottom of the shallow cavity of a concave, blackened disk of brass. For security each disk is provided with a removable fenestrated brass cap having a top of thin glass. These disks are arranged in concentric rows upon a large circular metal plate which occupies the place of the stage of an ordinary microscope. The circular plate is given both a rotary and a to-and-fro movement by means of a fric-

tion roller and a rack and pinion, so that all the mounts may be successively brought under the microscope. The specimens thus arranged are inclosed in a box having a glass top, through which the objective of a microscope projects.[1]

In the following catalogue the classification of Mr. H. B. Brady has been followed, as presented in "The report on the Foraminifera collected by H. M. S. *Challenger*," and his definitions of families and genera have been appropriated bodily. The analytical table is also compiled chiefly from the above-mentioned report. The descriptions of species have been prepared after study of the reserve series as well as of the typical specimens reproduced in the illustrations.

The localities given are only those from which specimens have been taken in selecting the series exhibited and in reserve, and do not profess to represent the distribution of the species.

A supplementary table gives the latitude, longitude, and depth of water of the stations referred to in the catalogue.

THE FORAMINIFERA.

The Foraminifera are minute aquatic, mostly marine, animals, having semifluid bodies, composed of granular protoplasm, inclosed in shells or "tests" either secreted by the animal or built up of available foreign material, such as mud, sand, sponge spicules, or dead shells. In zoological classification they belong to the Rhizopod group of the Protozoa, and are distinguished from other members of the group by the single character of the reticulated form assumed by their pseudopodia when extended.

These minute animals are interesting objects of study, geologically and biologically as well as esthetically. As objects of beauty they arrest the attention of even the casual observer by the delicacy of their structure as well as the symmetry and variety of their forms. Geologically they are of interest because they are among the most ancient and abundant of fossils and also the most efficient of rock builders. Biologically they are instructive examples of the powers and possibilities of an individualized bit of protoplasm—"a little particle of apparently homogeneous jelly, changing itself into a greater variety of forms than the fabled Proteus, laying hold of its food without members. swallowing it without a mouth, digesting it without a stomach, appropriating its nutritious material without absorbent vessels or a circulating system, moving from place to place without muscles, feeling (if it has any power to do so) without nerves, propagating itself without genital apparatus, and not only this, but forming shelly coverings of a

[1] This apparatus was devised by the writer and put on exhibition in the year 1890. It has been subjected to the very severe test of years of use by the general public, children as well as adults, to the number of hundreds each day, and this with only the occasional presence of an attendant in the room. See Report U. S. Nat. Mus., 1896, p. 96.)

symmetry and complexity not surpassed by those of any testaceous animals."[1]

From the resemblance of some of the shells of the foraminifera to those of the nautilus, they were for a long time regarded as minute cephalopod mollusks; that is, among the highest of the invertebrates, and it was not until the year 1835 that their true nature was discovered and announced by M. Dujardin to the French Academy of Sciences. Since that time the study of this order of animals has been pursued by able naturalists, and the results of their investigations appear in a voluminous literature. Much yet remains to be learned of the life history of the animal, but its zoological position is established and its importance in the economy of nature recognized.

As fossils the foraminifera are common in all geological systems from the Devonian upward, but they are especially abundant in Mesozoic and Cenozoic time. The chalk and many of the most extensive limestone beds are formed principally of their remains. As to present habitat, their shells are found wherever dredgings are made, all over the ocean floor except in the polar regions. A few species are "pelagic;" that is, they are found living at or near the surface of the water, but the weight of evidence is in favor of the conclusion that the vast majority of them pass all stages of life at the bottom, where they are found. In the experience of the naturalists of the *Albatross* it was rare to find any but the most minute and thin-shelled forms in the surface dredgings, and still more rare for any to be taken in the "wing nets" that were usually attached to the dredging apparatus.

The living foraminifer is a minute bit of viscid, granular protoplasm, without organs or tissues, without differentiation of substance into outer membrane and inner contents, and in most instances without evident nucleus or contractile vesicle. A nucleus has been recognized in a few individuals, and hence this characteristic element of most living cells is inferred to be present in all the members of the order. Like other Rhizopods, it has the power to protrude any parts of its body as "pseudopodia," for the purpose of locomotion or the prehension and absorption of food. It differs, however, from the other Rhizopods in that the pseudopodia do not necessarily remain distinct, but flow together whenever they touch one another, forming sometimes an elaborate and extended network of protoplasmic threads, which, however, may be readily retracted and flow again into the body mass, leaving no indication of their previous existence.

How the function of nutrition is accomplished and the nature and condition of the organic material used as food by these minute animals is not yet determined. Without doubt the pseudopodia are capable of seizing and inclosing small organic particles with which they may come in contact, and any part of the protoplasmic body, of which the pseudopodia are but temporary extensions, is able to digest and assimilate the

[1] Carpenter, Introduction to the Study of the Foraminifera.

nutritive portion. To further account for the necessary food supply, it is believed that the Foraminifera absorb organic matter held in solution by the sea water. This theory is the more easily accepted since we know that they have the power to separate inorganic matter (carbonate of lime in particular) from its solution, with which to construct, wholly or in part, their shells.

Of the process of reproduction little is known beyond the fact of multiplication by gemmation and fission. Every part of this simple animal being sufficient unto itself for purposes of nutrition and growth, it follows that a fragment of the protoplasmic body cast off from the parent becomes at once a new individual and the possible founder of a fresh colony. But it is not in accord with what we know of the life histories of other living things that this process of subdivision or propagation by cuttings or shoots can go on indefinitely. It is more likely that some kind of sexual reproduction takes place, the manner of which is yet to be demonstrated.

The most striking characteristic of this simple, semifluid animal, of indefinite and changeable shape, is its ability to construct a shell or test of definite form in which to shelter itself. This shell or test may be irregular, simple, and rude in construction, or symmetrical and of great delicacy and beauty, in variety of forms rivaling the shells of the Mollusca, of which it was long thought to be a diminutive example.

Structurally there are three quite definite and distinct types of testaceous covering. The first, to begin with the lowest and least common, is the "chitinous" test—a thin, transparent, yellowish or brownish membranous investment secreted by the animal. It has one or more general apertures, but is not perforated with fine foramina, and there is no means of communication between the inside and outside of the test except by the general apertures. The foraminifera with this kind of shell have been grouped in the single family of *Gromidæ*. As a rule they inhabit only fresh or brackish water. They have not been found in deep-water marine collections, and do not appear in the following catalogue.

The second type is the so-called "arenaceous" test. This is an investment constructed of grains of sand, or of the dead shells of other foraminifera, or of sponge spicules, or even of mud, cemented together more or less firmly by means of a calcareous cement secreted by the animal. Usually it has one or more general apertures of comparatively large size, and in addition there may be minute orifices between the sand grains, or other substances of which the test is constructed, through which the delicate threads of protoplasm can be projected. The surfaces may be rough and coarse or smooth and highly finished, according to the fineness of the material used and the amount of cement deposited in the crevices and angles between the grains. When constructed of mud these tests are found, in some instances, to have a chitinous base, which maintains the shape of the investment.

The third type of structure is a true shell, composed almost entirely of carbonates of lime and magnesia separated by the animal from their solution in the sea water, and fixed in solid form. It is through the agency of the foraminifera principally that the limestone, which is constantly being dissolved by rains and carried by rivers to the sea, is restored to the solid crust of the earth. Of these "calcareous" shells there are two kinds, quite distinct in appearance, known as "porcellanous" and "hyaline." The former are usually white, opaque, shining with the peculiar luster of porcelain, and "imperforate;" the latter are transparent, glassy, and "perforate," more or less densely, by minute, parallel, unbranched tubes for the passage of delicate pseudopodia. In both kinds there are usually one or more comparatively large, general apertures. Surface marking, or "ornamentation," is common in both the porcellanous and hyaline shells. In the former they take the form of striations or pittings, more or less regular and conspicuous; in the latter, of ridges, tubercles, or spines, of clear nontubular shell-substance, varying constantly in number and prominence among individuals of the same species.

Architecturally the first and most obvious division of these shells is into single-chambered (monothalamous, or unilocular) and many-chambered (polythalamous, or multilocular). While the primitive form of both the single and many chambered shells is evidently globular, yet the possibilities of ultimate conformation, depending chiefly upon direction of growth, are very great. Thus a monothalamous shell, beginning as an incomplete spherical chamber, may become ovate, flask-shaped, spindle-shaped, star-shaped, or tubular, and the tubular form may be straight, curved, coiled, or quite irregular. And these forms pass from one into another by quite insensible degrees. The polythalamous shell is a consequence of the process of reproduction by "gemmation," as the other is of reproduction by "fission." In this case the growing sarcode pushes outside the initial chamber until at a certain stage it builds a new wall around itself, while still maintaining connection with the parent cell. This second segment may give origin to a third, and so on until a colony is established, each offspring occupying an apartment added to the parental home. It is easy to see that the style of architecture of these tenements may be almost infinitely varied by varying the shape and position of these annexes. Each annex may have any of the forms of the monothalamous shells or any modification of them, and the arrangement may be in straight or curved lines, in concentric circles or planospiral coils, in single or double series spirally coiled, in two or three alternating series not spiral, or even in an irregular and disorderly mass.

Usually in the development of the polythalamous shell each successive segment uses the party walls of the preceding segments, so far as they may be available, in the construction of its own annex, but in some of the higher types of the hyaline series it will be found that

each chamber has a complete wall of its own, thus making double partitions between them. In some of these higher types there is developed also what is called a "supplemental skeleton," which consists of a deposit of shell-substance on the outside of the original wall, thereby adding to its thickness, filling in the hollows between the segments and at the umbilici, and sometimes growing out into protuberances of various shapes. This supplemental skeleton is generally traversed by a set of canals or sinuses—passages left during the deposit of the shell-substance, and probably occupied by threads of sarcode during the life of the animal.

The separation into families, genera, and species of a group of animals like the foraminifera, where variation is the rule and passage from one type to another is by a sliding scale and not even by a series of steps, is extremely difficult, and must always remain unsatisfactory in some particulars; but for convenience of reference, if for no other reason, a classification of some sort is demanded, and various schemes, which it is unnecessary here to enumerate, have been put forth to bridge the difficulty. In all these schemes the primary divisions are founded upon the structure of the test as above described—that is, whether chitinous, arenaceous, or calcareous, and whether perforate or imperforate. Beyond these distinctions, which seem to have a physiological foundation, there is nothing upon which to base a classification but the form of the test, which, as we have seen, is never determinate enough to permit of the establishment of fixed boundary lines. Generic and specific names of foraminifera, therefore, must not be considered as having much zoological value, but only as convenient titles applied to certain typical forms around which many varieties may be grouped. And it must be remembered that, however elastic the definitions of species, or even genera, there will often be a margin of doubt, and the determination of place in the classification must be left to the preference of the individual observer.

A few words concerning the manipulation of material and specimens may be of assistance to those beginning the study of the foraminifera.

Collection of recent shallow-water forms may be made from shore sands, from the anchor and chains, and especially from the "chain lockers" of ships, from sponge sand, and by means of boat dredges from the shallow waters of the coast. Deep-water forms are only obtainable by special apparatus, such as is used in deep sea sounding or in purely scientific explorations of the ocean bed. The specimens may be freed from mud by the process of decantation—that is, repeatedly agitating in water, and, after a very brief period to allow subsidence of the shells, pouring off the turbid surface water. Or the material may be put in a bag made of fine bolting cloth and the bag shaken in a bucket of water. The remaining foraminifera, mixed with more or less sand, pteropod shells, sponge spicules, and débris of various sorts, should then be thoroughly dried, bottled, and labeled.

For examination of the dried material a dissecting microscope stand,

with a good acromatic lens magnifying about 10 diameters, is most convenient. A small quantity of the material in a shallow watch glass blackened on the under side, being placed under the lens, is carefully inspected, and when a specimen is found which it is desired to preserve it may be readily removed by means of a very fine camel's-hair pencil slightly moistened between the lips. Transfer of specimens should be attempted with the moistened pencil only, as the use of forceps is certain to crush the delicate shells.

For preservation of the identified specimens in numbers for study nothing is better than wooden slides of regulation size—1 by 3 inches. These may have either a concavity drilled in one side nearly through the wood and painted black, or a hole bored entirely through the slide and one side covered with heavy blackened paper. A removable cover to this little cavity may be cut from a thin sheet of mica and held in place either by a spring clamp or by slipping it under the thin paper front of the slide, which is left unglued about the center for that purpose.

To make a section the specimen should be attached in the desired attitude to the face and near the end of a glass slip by means of the minutest drop of liquid glue. The attitude of the specimen must be carefully preserved until the glue has set. The shell is then covered with chloroform or xylol balsam, which may be made to penetrate the chambers of the shell and be rapidly hardened by the application of direct heat up to the boiling temperatnre. Superfluous balsam being cut away, the shell supported by the balsam is rubbed lightly upon a hone, kept thoroughly wet with water, until the desired section is exposed. The balsam is then dissolved away by chloroform, and the glue by water, and the specimen mounted.

The manner in which specimens shall be mounted will depend upon the preferences or ingenuity of the preparator, and the arrangements he may make for the storage of his collection. If a cover-glass is used it should not be sealed on, as the underside of the glass is almost certain to "sweat" sooner or later, and obscure the specimen. It may be worth while to say that for the attachment of the shells to any surface the author has not found anything better than microscopists' gold size. The best instrument for transferring the minute drop of adhesive material of whatever kind to the point where the shell is to be attached is the finest obtainable sewing needle, the eye end inserted in a slender handle and the point broken off at the thickest part of the needle.

The literature of the subject is very large, though most of it is to be found in journals of natural history and transactions of societies. With Carpenter's "Introduction to the Study of the Foraminifera," Brady's "Report on the Foraminifera collected by H. M. S. *Challenger*," and Sherborn's "Index to the Genera and Species of the Foraminifera," the student will be able to begin work in an intelligent manner and to find references to all that has been published on this subject up to the most recent date.

ANALYTICAL KEY TO FAMILIES.

Subkingdom PROTOZOA.—Body consisting of a minute mass of protoplasm, or an aggregation of such masses, without differentiation of parts into organs or tissues, either with or without a testaceous envelope or skeletal framework.

Class RHIZOPODA.—Protoplasmic body capable of protruding any portion of its substance in the shape of lobes, bands, or threads, for the purpose of locomotion or the prehension of food; generally more or less completely inclosed in a testaceous envelope; nucleus and contractile vesicle present or absent.

Order FORAMINIFERA.—Pseudopodia protruded as fine threads which flow together wherever they touch, forming a network of granular protoplasm; nucleus and vacuoles generally indistinguishable; tests either chitinous, calcareous, or of agglutinated sand or shells, never silicious.

Test chitinous, sometimes encrusted with foreign bodies.
  Aperture at one or both extremities........................Family I. GROMIDÆ.
Test arenaceous (composed of mud, sand, shells, or sponge spicules).
  Relatively large, one-chambered, or sometimes unsymmetrically segmented by constriction or adhesion, never truly septate......Family II. ASTRORHIZIDÆ.
  Relatively small, usually regular in contour, one or many chambered; many-chambered forms sometimes imperfectly septate, often labyrinthic:
    Family III. LITUOLIDÆ.
Test arenaceous or calcareous.
  Segments in two or more alternating series, or spiral or confused, often dimorphous ....Family IV. TEXTULARIDÆ.
Test calcareous.
  Imperforate, porcellanous..................................Family V. MILIOLIDÆ.
  Perforate, hyaline.
    Chambers one, or many joined in a straight, curved, spiral, alternating, or branching series; aperture simple or radiate, terminal:
      Family VI. LAGENIDÆ.
    Chambers more or less embracing, following each other from the same end, or alternately at either end, or in cycles of three:
      Family VII. CHILOSTOMELLIDÆ.
    Chambers comparatively few, inflated, spirally arranged; apertures single or multiple, conspicuous ....Family VIII. GLOBIGERINIDÆ.
    Chambers typically spiral and rotaliform—all the segments visible on the upper side, those of the last convolution only on the lower (apertural) side. Aberrant forms evolute, outspread, acervuline, or irregular:
      Family IX. ROTALIDÆ.
    Chambers spiral or concentric; shell symmetrical, usually lenticular or discoidal ....Family X. NUMMULINIDÆ.

ANALYTICAL KEY TO GENERA.

Family I. GROMIDÆ.

Aperture single.
  Test large, ovate.
    Mouth central, in a depression at the broad end; test closely adherent to the body of the animal..............................Genus *Lieberkuhnia*.
    Mouth terminal; test not adherent..........................Genus *Gromia*.
  Test minute, ovate.
    Mouth prominent, one-sided..........................Genus *Mikrogromia*.
  Test composed largely of foreign bodies (diatoms, etc.)...Genus *Diaphoropodon*.
Aperture at each end.
  Test hyaline, tubular, cylindrical, or flattened..............Genus *Shepheardella*.

Family II. ASTRORHIZIDÆ.

Walls thick, composed of sand or mud, slightly cemented..Subfamily ASTRORHIZINÆ.
Fusiform, branching, or flattened with angular or radiate margin; aperture at the end of each ray or branch ....Genus *Astrorhiza*.
More or less flask shaped or subcylindrical; aperture single, terminal: Genus *Pelosina*.
Subglobular, very irregular externally; apertures numerous, in horn-like protuberances..Genus *Storthosphæra*.
Columnar, branching, or irregularly outspread; adherent; apertures terminal: Genus *Dendrophrya*.
A rounded mass of radiating, branching tubes arranged in more or less distinct layers..Genus *Syringammina*.
Walls thick, composed of felted sponge spicules and fine sand, uncemented: Subfamily PILULININÆ.
Spherical; aperture a long, curved slit ....Genus *Pilulina*.
Subspherical, labyrinthic or cavernous, or having a central undivided cavity with subcavernous walls; no general aperture ....Genus *Crithionina*.
Oval or subcylindrical; aperture typically a rounded orifice at one end: Genus *Technitella*.
Cylindrical, long, slightly tapering, open at both ends.......Genus *Bathysiphon*.
Walls thin, composed of sand grains firmly cemented; test nearly spherical: Subfamily SACCAMMININÆ.
A single globular chamber, without general aperture.....Genus *Psammosphæra*.
A number of adherent globular chambers, without general aperture: Genus *Sorosphæra*.
One or several globular, pyriform or fusiform chambers, with or without tubular connection; apertures distinct ....Genus *Saccammina*.
Walls composed of firmly cemented sand grains, often mixed with sponge spicules; test tubular, sometimes imperfectly segmented..Subfamily RHABDAMMININÆ.
Elongate, tapering, simple; aperture at the broad end ....Genus *Jaculella*.
Elongate, cylindrical, simple or branched; aperture at one end, the other end rounded, sometimes inflated..............................Genus *Hyperammina*.
Fusiform or cylindrical, largely composed of sponge spicules; aperture at each end..Genus *Marsipella*.
Rectilinear, radiate or branching, with or without a central chamber; apertures at the open ends of the tubes ....Genus *Rhabdammina*.
Very variable, usually consisting of irregular inflated sacs, single or united; apertures multiple, tubulated...........................Genus *Aschemonella*.
Tubular, slender, flexible, simple or branched, chitino-arenaceous, in nonadherent masses ....Genus *Rhizammina*.
Tubular, branching, reticulated, adherent to the surface of shells or stones; apertures terminal ....Genus *Sagenella*.
Subcylindrical, adherent at one end, rounded at the other, constructed of loose sand grains; imperfectly septate ....Genus *Botellina*.
Columnar, straight or crooked, adherent by an expanded base, enlarging or branching toward the apex; aperture terminal ....Genus *Haliphysema*.

Family III. LITUOLIDÆ.

Test composed of coarse sand grains, rough externally......Subfamily LITUOLINÆ.
Not labyrinthic.
Test free.
Chambers one, or several united in a straight, curved, or irregular line, never spiral...Genus *Reophax*.
Chambers numerous, partly or entirely spiral...Genus *Haplophragmium*.

Test composed of coarse sand grains, etc.—Continued.
  Not labyrinthic—Continued.
    Test adherent.
      Chambers numerous, planoconvex.................... Genus *Placopsilina*.
  Labyrinthic.
    Test free.
      Chambers uniserial, straight or curved, never spiral.. Genus *Haplostiche*.
      Chambers partly or entirely spiral...................... Genus *Lituola*.
    Test adherent.
      Chambers linear, vermiform, closely approximated; apertures a row of pores on each septal face .... Genus *Bdelloidina*.
Test composed of fine sand, smooth externally......... Subfamily TROCHAMMININÆ.
  Chambers one.
    Globular with several mammilate apertures .... Genus *Thurammina*.
    Elongate, conical, with a large curved or irregular aperture at the basal extremity .... Genus *Hippocrepina*.
    A single tube coiled upon itself in various ways; sometimes constricted, never truly septate .... Genus *Ammodiscus*.
    Adherent, hemispherical, with or without a long slender tubular neck: Genus *Webbina*.
  Chambers several.
    United in a straight or curved line; rarely a single chamber: Genus *Hormosina*.
    Rotaliform, nautiloid, or trochoid; more or less distinctly septate: Genus *Trochammina*.
    Rotaliform; test composed of fusiform calcareous spicules.. Genus *Carterina*.
Test relatively large, composed of fine sand; chambers arranged spirally or in concentric layers; walls cancellated..................... Subfamily LOFTUSINÆ.
  Lenticular or subglobular; chambers numerous, spiral, nautiloid: Genus *Cyclammina*.
  Fusiform or subglobular, elongated axially; chambers spiral.... Genus *Loftusia*.
  Spheroidal, compressed; chambers in concentric layers......... Genus *Parkeria*.
Test more or less calcareous; distinctly septate; exclusively fossil: Subfamily ENDOTHYRINÆ.
  Nodosariform; chambers sometimes slightly labyrinthic; aperture simple: Genus *Nodosinella*.
  Cylindrical, attached by one end; chambers labyrinthic; aperture terminal cribrate.. Genus *Polyphragma*.
  Lenticular, consisting of a planospiral tube with a deposit of shell substance on both sides... Genus *Involutina*.
  Nautiloid or rotaliform; aperture simple, at the inner margin of the final chamber... Genus *Endothyra*.
  Nautiloid; aperture a number of pores on the face of the terminal chamber: Genus *Bradyina*.
  Adherent; consisting of numerous subdivided segments, or of a mass of chamberlets.. Genus *Stacheia*.

Family IV. TEXTULARIDÆ.

Test typically bi- or tri-serial; often dimorphous......... Subfamily TEXTULARINÆ.
  Monomorphous.
    Segments alternating, in two rows.
      Aperture an arched slit at or near the inner angle of the last segment: Genus *Textularia*.
      Test compressed at right angles to the normal plane... Genus *Cuneolina*.

Test typically bi- or tri-serial, etc.—Continued.

Monomorphous—Continued.

Segments alternating in three rows.

Aperture as in *Textularia* .... Genus *Verneuilina*.

Aperture simple, produced, central .... Genus *Tritaxia*.

Aperture porous .... Genus *Chrysalidina*.

Segments arranged spirally, with three chambers in each convolution.

Aperture partially covered by a valvular lip .... Genus *Valvulina*.

Dimorphous.

Early chambers biserial, later ones uniserial and rectilinear: Genus *Bigenerina*.

Early chambers small and biserial, later ones broadly arched and uniserial: Genus *Paronina*.

Early chambers planospiral, later ones biserial .... Genus *Spiroplecta*.

Early chambers triserial, later ones uniserial and rectilinear: Genus *Clavulina*.

Early chambers triserial, later ones biserial .... Genus *Gaudryina*.

Test typically spiral; sometimes bi- or tri-serial; aperture oblique, comma-shaped or some modification of that form .... Subfamily BULIMININÆ.

Monomorphous.

Spiral, elongate, more or less tapering, often triserial .... Genus *Bulimina*.

Much elongated, with a tendency to become asymmetrically biserial: Genus *Virgulina*.

Distinctly biserial, Textularian .... Genus *Bolivina*.

Biserial; aperture an arched or semicircular orifice with a vertical notch on the septal face of the last segment .... Genus *Pleurostomella*.

Dimorphous.

Early segments bulimine or virguline, later ones uniserial .. Genus *Bifarina*.

Test consisting of a double series of alternating segments, more or less coiled upon itself .... Subfamily CASSIDULININÆ.

Folded on its long axis, and coiled more or less completely upon itself: Genus *Cassidulina*.

Broad, arched on the dorsal side, slightly coiled .... Genus *Ehrenbergia*.

Family V. MILIOLIDÆ.

Test irregular, asymmetrical: aperture variable .... Subfamily NUBECULARINÆ.

Chamber one, inflated, adherent; aperture on the convex surface: Genus *Squamulina*.

Chambers more than one, in linear or very irregularly spiral series: Genus *Nubecularia*.

Test coiled on an elongated axis, in a single plane or inequilaterally; chambers two in each convolution .... Subfamily MILIOLININÆ.

Chambers in a single plane, embracing, the last two only visible: Genus *Biloculina*.

Chambers biloculine but subdivided in the interior .... Genus *Fabularia*.

Chambers in a single plane, all visible on both sides of the shell: Genus *Spiroloculina*.

Chambers inequilateral, coiled round the long axis of the shell so that more than two (usually three or five) are visible .... Genus *Miliolina*.

Test dimorphous; partly milioline, partly spiral or rectilinear: Subfamily HAUERININÆ.

Early chambers milioline, subsequently in a straight series .... Genus *Articulina*.

Early chambers partly milioline and partly planospiral, subsequently in a straight series .... Genus *Vertebralina*.

Early chamber an undivided planospiral tube, subsequently with two or more segments in each convolution .... Genus *Ophthalmidium*.

Test dimorphous, etc.—Continued.

Early chambers milioline, subsequently planospiral with more than two segments in each convolution .... Genus *Hauerina*.

Chambers equitant, arranged as in Hauerina, the last convolution covering the previous whorls .... Genus *Planispirina*.

Test planospiral or cyclical, sometimes crozier-shaped, bilaterally symmetrical: Subfamily PENEROPLIDINÆ.

Chamber one, an undivided planospiral tube .... Genus *Cornuspira*.

Chambers numerous, undivided, planospiral or spiral at first and rectilinear or cyclical afterwards .... Genus *Peneroplis*.

Chambers subdivided transversely; early segments embracing; arrangement wholly planospiral or partly cyclical .... Genus *Orbiculina*.

Chambers subdivided into chamberlets; test discoidal .... Genus *Orbitolites*.

Test spiral, elongated in the line of the axis of convolution .. Subfamily ALVEOLININÆ.

Subglobular, elliptical, or fusiform .... Genus *Alveolina*.

Test spherical; chambers in concentric layers .... Subfamily KERAMOSPHÆRINÆ.

Chambers very numerous, irregularly shaped .... Genus *Keramosphæra*.

Family VI. LAGENIDÆ.

Test monothalamous .... Subfamily LAGENIDÆ.

A single undivided chamber .... Genus *Lagena*.

Test polythalamous, straight, arcuate or planospiral .... Subfamily NODOSARINÆ.

Monomorphous.

Straight or curved, circular in transverse section; aperture central: Genus *Nodosaria*.

Straight, compressed; aperture typically a narrow fissure .. Genus *Lingulina*.

Compressed or complanate; segments V-shaped, equitant: Genus *Frondicularia*.

Straight or slightly curved, triangular or quadrangular in section: Genus *Rhabdogonium*.

Elongate, curved, circular in section; aperture marginal: Genus *Marginulina*.

Elongate, compressed or complanate; septation oblique; aperture marginal: Genus *Vaginulina*.

Vaginuline; septation very oblique; aperture a long slit down the ventral face of the final segment .... Genus *Rimulina*.

Planospiral in part or entirely; complanate, lenticular, crozier-shaped or ensiform .... Genus *Cristellaria*.

Dimorphous.

Early segments *Cristellarian*, later ones Nodosarian ...... Genus *Amphycoryne*.

Early chambers *Cristellarian*, later ones Linguline ...... Genus *Lingulinopsis*.

Early chambers *Cristellarian*, later ones Frondicularian .... Genus *Flabellina*.

Early chambers *Frondicularian*, later ones Nodosarian: Genus *Amphimorphina*.

Early chambers *Rhabdogonian*, later ones Nodosarian .... Genus *Dentalinopsis*.

Test polythalamous; segments arranged spirally around the long axis; rarely biserial and alternate .... Subfamily POLYMORPHININÆ.

Monomorphous.

Segments bi- or tri-serial or irregularly spiral; aperture radiate: Genus *Polymorphina*.

Segments arranged spirally around the long axis of the shell (rarely biserial); aperture simple, usually surrounded by a phialine lip: Genus *Uvigerina*.

Dimorphous.

Early segments *Polymorphine*, later ones Nodosarian ..... Genus *Dimorphina*.

Early segments *Uvigerine*, later ones Nodosarian .... Genus *Sagrina*.

Test irregularly branching.................................Subfamily RAMULININÆ.
Composed of spherical or pyriform chambers, connected by long stoloniferous tubes..Genus *Ramulina.*

Family VII. CHILOSTOMELLIDÆ.

Segments oval, each springing from the base of the previous one and entirely enveloping it..Genus *Ellipsoidina.*
Segments oval, put on alternately at either end of the test.....Genus *Chilostomella.*
Segments alternating at three sides so as to leave exposed portions of two segments and the whole of the final one............................Genus *Allomorphina.*

Family VIII. GLOBIGERINIDÆ.

Test a single spherical chamber perforated with large and small foramina: Genus *Orbulina.*
Test rotaliform, trochoid or planospiral; segments few, inflated, coarsely perforated: Genus *Globigerina.*
Test regularly nautiloid and involute; walls thin, finely perforated, spinous: Genus *Hastigerina.*
Test regularly or obliquely nautiloid and involute; walls thick, smooth, very finely perforated..Genus *Pullenia.*
Test nearly globular, composed of a few coiled segments.........Genus *Sphæroidina.*
Test trochoid, segments inflated, finely perforated; aperture consisting of rows of pores along the septal depressions..........................Genus *Candeina.*

Family IX. ROTALIDÆ.

Test spiral, nonseptate....................................Subfamily SPIRILLININÆ.
A complanate, nonseptate tube, free or attached...............Genus *Spirillina.*
Test spiral, septate, rotaliform; rarely evolute, very rarely irregular or acervuline: Subfamily ROTALINÆ.
Conical; consisting of an external spiral or annular layer of chambers, the interior of the cone being filled with hyaline substance or by a mass of compressed chambers..Genus *Patellina.*
Trochoid or complanate, spiral at the apex, later segments often annular or irregular; apertures opening into a deep central vestibule, or sometimes consisting of sutural pores or bordered foramina.............Genus *Cymbalopora.*
Trochoid or planoconvex, rarely complanate; rather coarsely porous; aperture an arched slit at the umbilical margin of the last segment, often protected by an umbilical flap..Genus *Discorbina.*
Complanate; early segments spiral, later ones cyclical; apertures peripheral: Genus *Planorbulina.*
Upper side usually more convex than the lower; very finely porous; aperture a large slit at the umbilical end of the inferior sutural margin of the last segment...Genus *Pulvinulina.*
Lower side usually the more convex; very finely porous; aperture a neatly arched slit near the middle of the inferior sutural margin of the last segment: Genus *Rotalia.*
Lower side usually the more convex; coarsely porous; aperture near the outer end of the final suture, sometimes with a phialine neck...Genus *Truncatulina.*
Nearly alike on the two faces; coarsely porous...............Genus *Anomalina.*
Lenticular, periphery furnished with radiating spines..........Genus *Calcarina.*
Convex or monticulate, adherent; segments few, spreading radially or superimposed; aperture at the end of the final segment..........Genus *Carpenteria.*
Columnar, adherent by a slightly spreading base; segments numerous, spiral; aperture at the inner margin of the final segment.............Genus *Rupertia.*

Test consisting of irregularly heaped chambers............Subfamily TINOPORINÆ.
Lenticular or subsphæroidal, with radiating marginal spines and tuberculated surface; chambers arranged in tiers on each side of a central planospiral disk: Genus *Tinoporus*.
Sphæroidal or spreading, without spines; free or adherent, structure acervuline, radiating or laminated; chambers rounded or polyhedral, coarsely perforated; no general aperture..Genus *Gypsina*.
Planoconvex, spreading, adherent; chambers acervuline; wall finely perforated; apertures numerous, marginal............................Genus *Aphrosina*.
Columnar, branching, attached by the base; segments numerous, crowded around the long axis; coarsely perforated; no general aperture: Genus *Thalamopora*.
Encrusting or branching, parasitic; surface areolated; color pink or sometimes white..Genus *Polytrema*.

Family X. NUMMULINIDÆ.

Bilaterally symmetrical; chambers extending from end to end and arranged in convolutions perpendicular to the long axis of the shell..Subfamily FUSULININÆ.
Fusiform or subglobular; chambers entire.....................Genus *Fusulina*.
Subglobular, elongated or subcylindrical; chambers subdivided by secondary septa..Genus *Schwagerina*.
Bilaterally symmetrical, nautiloid...................Subfamily POLYSTOMELLINÆ.
Supplemental skeleton absent or rudimentary; no external septal pores or bridges; aperture a curved slit...........................Genus *Nonionina*.
Supplementary skeleton, septal bridges and canal system present; aperture a V-shaped line of perforations at the base of the septal face..Genus *Polystomella*.
Lenticular or complanate.............................Subfamily NUMMULITINÆ.
Lenticular, consisting of a coiled nonseptate tube embedded in a mass of shell substance...Genus *Archædiscus*.
Lenticular, spiral, inequilateral; chambers equitant, simple above, constricted into two portions below.............................Genus *Amphistegina*.
Complanate and planospiral, all the convolutions visible; chambers undivided: Genus *Operculina*.
Complanate and planospiral; chambers divided into chamberlets: Genus *Heterostegina*.
Lenticular, planospiral, equilateral; chambers equitant, each convolution nearly or quite enclosing all the previous ones..................Genus *Nummulites*.
Complanate, regular, equitant, but the alar prolongations thin and transparent, exposing the outlines of previous convolutions ....Genus *Assilina*.
Complanate with thickened center, or lenticular.......Subfamily CYCLOCLYPEINÆ.
Composed of a single layer of chambers arranged in concentric annuli, with superimposed laminæ of finely tubulated shell substance thickest at the center: Genus *Cycloclypeus*.
Composed of a single layer of concentric chambers, with superimposed layers of flattened chamberlets....................................Genus *Orbitoides*.

CATALOGUE.

Family II. ASTRORHIZIDÆ.

Test invariably composite, usually of large size and monothalamous; often branched or radiate, sometimes segmented by constriction of the walls, but seldom or never truly septate; polythalamous forms never symmetrical.

Subfamily ASTRORHIZINÆ.

Walls thick, composed of loose sand or mud, very slightly cemented.

Genus ASTRORHIZA.

Test fusiform or depressed. Depressed forms either sublenticular with angular or irregularly radiate margin, or in branching masses. Apertures at the end of each ray or branch.

ASTRORHIZA GRANULOSA Brady.

(Plate 1.)

Test fusiform, composed of fine gray sand rather loosely cemented; cavity a tube of nearly uniform diameter, open at both ends; extremities of the test often tinged brown. Section shows thickness of shell and dimensions of cavity. Length, 4.5 mm. ($\frac{3}{16}$ inch), more or less.

Locality.—North Atlantic (stations 2568, 2570, 2723), 1,685 to 1,781 fathoms.

ASTRORHIZA CRASSATINA Brady.

(Plate 2.)

Test elongate, irregularly cylindrical. Differs from *A. granulosa* in that the cavity is more or less constricted at uncertain intervals. Length, 6 mm. ($\frac{1}{4}$ inch) or more.

Localities.—North Atlantic off Georges Bank, off Long Island, and off Chesapeake Bay (stations 2570, 2586, 2723), 328 to 1,813 fathoms.

ASTRORHIZA ANGULOSA Brady.

(Plate 3, fig. 1.)

Test irregularly triangular, depressed, thick, fragile, composed of fine gray sand loosely coherent; cavity a central globular chamber with tubes radiating to the angles and terminating in simple apertures. Section to show the cavity.

Locality.—Marthas Vineyard (station 2569), 1,782 fathoms.

ASTRORHIZA ARENARIA Norman.

(Plate 3, fig. 2.)

Test compressed, radiate or branched, composed of fine gray sand loosely cemented; very fragile; cavity corresponds with the form of the test; aperture at the end of each ray or branch.

Localities.—Off Marthas Vineyard and Georges Bank (stations 2547, 2570, 2586), 328 to 1,813 fathoms.

Genus PELOSINA.

Test free, typically monothalamous; rounded, cylindrical, tapering or irregularly fusiform; walls composed of mud with a chitinous lining; aperture single, terminal.

PELOSINA VARIABILIS Brady.

(Plate 4, fig. 1.)

Specimens both cylindrical and flask-shaped, one of them consisting of two quite irregular chambers; walls composed of mud with an occasional adhering shell. Length, 3 to 6 mm. ($\frac{1}{8}$ to $\frac{1}{4}$ inch). Much larger specimens are common.

Locality.—Gulf of Mexico (station 2395), 347 fathoms.

Genus STORTHOSPHÆRA.

Test subglobular, very irregular externally; interior smooth.

STORTHOSPHÆRA ALBIDA Schultze.

(Plate 4, fig. 2.)

Subglobular or ovoid; surface roughened by prominent, rather thin ridges and protuberances; wall of medium and variable thickness, composed of very fine sand loosely cemented; cavity rounded, smooth; no visible aperture; color very light gray. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Gulf of Mexico (station 2385), 730 fathoms.

Subfamily PILULININÆ.

Test monothalamous; walls thick, composed chiefly of felted sponge spicules and fine sand, without calcareous or other cement.

Genus PILULINA.

Test nearly spherical: aperture a long and more or less curved slit.

PILULINA JEFFREYSII Carpenter.

(Plate 5.)

Test spherical, thin, fragile, composed of sponge spicules and fine sand; cavity undivided, smooth; aperture a narrow curved slit with slightly protuberent lips. Section shows the large smooth cavity with thin walls. Diameter varies from 1.25 to 3 mm. ($\frac{1}{20}$ to $\frac{1}{8}$ inch).

Locality.—North Atlantic; station not recorded.

Genus CRITHIONINA.

Labyrinthic or cavernous, or having a central undivided cavity with subcavernous walls.

CRITHIONINA PISUM Goës.

(Plate 6, fig. 1.)

Usually globular, sometimes elongated or compressed; surface regular; wall thick, soft, composed of fine sand and sponge spicules very

loosely aggregated; color grayish white; cavity smooth, with or without more or less numerous pits or depressions in the walls; no traces of septa; no visible aperture. Average diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—North Atlantic, off Marthas Vineyard and Block Island (stations 2584, 2586, 2221, 2234), 328 to 1,525 fathoms.

CRITHIONINA PISUM, variety HISPIDA, new.

(Plate 6, fig. 2.)

In form like *C. pisum*, but smaller; characterized by the bristly appearance of the surface, caused by the projection of great numbers of sponge spicules arranged for the most part nearly perpendicular to the surface of the test. The very hispid tests have thinner walls than those with fewer projecting spicules; texture of walls and shape of cavity same as *C. pisum*. No visible aperture.

Localities.—Southeast of Georges Bank, Gulf of Mexico, and coast of Oregon (stations 2570, 2571, 2379, 2394, 3080), 93 to 1,813 fathoms.

Genus BATHYSIPHON.

Test long, cylindrical, slightly tapering; in the form of a straight or curved tube open at both ends.

BATHYSIPHON RUFUM de Folin.

(Plate 7.)

Test long, very slender, tapering gradually, smooth and polished externally, rather conspicuously constricted at very irregular intervals along its whole length; color a rich reddish brown; walls of medium thickness, composed of fine sand firmly and evenly cemented; cavity corresponds to the external form, the constrictions being equally marked within and without; apertures simple and terminal. Length, 3 to 9 mm. ($\frac{1}{8}$ to $\frac{1}{3}$ inch); diameter, 0.375 mm. ($\frac{1}{65}$ inch) or less.

Localities.—Gulf of Mexico and off the coast of Brazil (stations 2385, 2760), 730 to 1,019 fathoms.

Subfamily SACCAMININÆ.

Chambers nearly spherical; walls thin, composed of firmly cemented sand grains or shells of foraminifera.

Genus PSAMMOSPHÆRA.

Test a single globular chamber without any general aperture, the pseudopodia issuing from interstitial orifices.

PSAMMOSPHÆRA FUSCA Shulze.

(Plate 8, fig. 1.)

Nearly spherical, free or adherent, rough, constructed of comparatively large white grains of sand firmly cemented in a single layer: cavity as smooth as the nature of the material will admit, but not lined with cement substance, nor are the angles between the sand grains smoothly filled; no general aperture; color of the cement substance light grayish brown. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Off Havana (station 2343), 279 fathoms. A variety of this species, taken off the coast of South Carolina, has a test constructed of coarse black sand: the cement is light brown, as in the other.

PSAMMOSPHÆRA FUSCA, variety TESTACEA, new.

(Plate 8, fig. 2.)

Differs from the type principally in the composition of the walls, which are constructed of a single layer of dead shells of foraminifera. It is generally larger and very rough, resembling an accidental agglomeration of shells, but showing in section a smooth cavity, as in the strictly arenaceous forms.

Locality.—Found only in the Gulf of Mexico (stations 2358, 2383, 2399), 196 to 1,181 fathoms.

PSAMMOSPHÆRA PARVA (P. FUSCA Brady).

(Plate 9, fig. 1.)

Test free or adherent; spherical when free; when adherent having a smooth facet, usually with an incomplete wall on the attached side. Diameter, about 0.625 mm. ($\frac{1}{40}$ inch); walls thin, composed of fine sand firmly united, the cement substance filling in smoothly the interstices and angles of the sand grains, both externally and internally; test often built around a long sponge spicule, which transfixes the test, both ends of the spicule protruding; color deep reddish brown. This species is included with *P. fusca* by Brady, "Report on the Foraminifera," but the characters are quite distinct, and no intermediate forms have been found.

Locality.—Coast of Brazil (station 2760), 1,019 fathoms.

Genus SACCAMMINA.

One or several globular, pyriform or fusiform chambers, with distinct apertures. Polythalamous forms, with or without stoloniferous connections between the chambers.

SACCAMMINA SPHERICA M. Sars.

(Plate 9, fig. 2.)

Test globular or slightly pear shaped, smoothly and strongly built of medium-sized grains of sand: aperture a simple tubular opening in the more or less protuberant end of the shell. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Off the Coast of Brazil (station 2760), 1,019 fathoms.

SACCAMMINA CONSOCIATA, new species.

(Plate 9, fig. 3.)

Free or adherent, subglobular; surface coarse and rough; walls thin, composed of rather coarse sand mixed with sponge spicules: color a rich reddish brown: orifices one or several, at the end of long slender tubes. Generally united into colonies, either in straight series, or curved, or confused, connected by stoloniferous tubes. Diameter of individual tests, 0.4 to 0.8 mm. ($\frac{1}{60}$ to $\frac{1}{30}$ inch).

Locality.—Off Bahia, Brazil (station 2760), 1,019 fathoms.

Subfamily RHABDAMMININÆ.

Test composed of firmly cemented sand grains, often with sponge spicules intermixed: tubular: straight, radiate, branched, or irregular; free or adherent, with one, two, or more apertures; rarely segmented.

Genus JACULELLA.

Test elongate, tapering; aperture at the broad end.

JACULELLA ACUTA Brady.

(Plate 9, fig. 4.)

Long, cylindrical, tapering, closed at the pointed end when perfect, open at the broad end: walls constructed of coarse sand: surface rough: color, light brown. Length, about 3 mm. ($\frac{1}{8}$ inch).

Locality.—Not recorded.

Genus HYPERAMMINA.

Test free or adherent: consisting of a long, simple or branching, arenaceous tube, the primordial end of which is closed and rounded: the opposite extremity, which is open and but little if at all constricted, forming the general aperture; interior smooth.

HYPERAMMINA FRIABILIS Brady.

(Plate 10, fig. 1.)

Test free, consisting of a long straight tube, one end closed and slightly inflated, the other end slightly contracted, forming a simple rounded aperture; cavity corresponds to the external form of the test;

walls thin, constructed of moderately fine sand, or sometimes almost entirely of sponge spicules.

Localities.—North Atlantic and the Gulf of Mexico (stations 2399, 2400, 2234, 2570), 200 to 1,800 fathoms.

HYPERAMMINA ELONGATA Brady.

(Plate 10, fig. 2.)

Long, straight, slender, cylindrical, the inferior extremity slightly inflated and closed, the oral end little if at all contracted; composed either of fine sand or of broken sponge spicules firmly cemented; color deep reddish brown. Differs from *H. friabilis* in the much smaller diameter of the cylinder, the relatively greater length, and the firmer walls.

Localities.—Gulf of Mexico, the North Atlantic 200 miles southeast of Marthas Vineyard, and the coast of Brazil (stations 2394, 2568, 2760, 2352, 2355, 2399), 190 to 1,781 fathoms.

HYPERAMMINA RAMOSA Brady.

(Plate 11, fig. 1.)

Test free, commencing as a globular, inflated chamber, continuing as a long, crooked, branching tube; walls composed of sand or of sand mixed with sponge spicules; color, light brown.

Localities.—Off Cape Hatteras and in the Gulf of Mexico (stations 2115, 2352, 2383), 463 to 1,181 fathoms.

HYPERAMMINA VAGANS Brady.

(Plate 11, fig. 2.)

Test commences in a spherical chamber and continues as a slender unbranched tube of nearly even diameter and of indefinite length; sometimes partly free, but for the most part wandering over the surface of fragments of shells of mollusks, or of foraminifera, in a confused, tortuous and aimless way, or coiled irregularly upon itself; walls thin, composed of fine sand; color brown.

Locality.—Gulf of Mexico (station 2399), 196 fathoms.

Genus MARSIPELLA.

Test fusiform or cylindrical, with an aperture at each end; largely composed of sponge-spicules, especially near the extremities.

MARSIPELLA ELONGATA Norman.

(Plate 12, fig. 1.)

Long, slender, fusiform, curved or crooked; walls thin, composed of sand or sponge-spicules, or both, the middle portion of the test usually having the larger proportion of sand; in some instances a layer of sand

overlies the fundamental structure of sponge-spicules. Length, 3 to 4 mm. ($\frac{1}{8}$ to $\frac{1}{6}$ inch).

Localities.—Caribbean Sea, Gulf of Mexico, and off Cape Fear (stations 2150, 2383, 2677), 382 to 1,181 fathoms.

Genus RHABDAMMINA.

Test rectilinear, radiate, or irregularly branching; with or without a central chamber; the open ends of the tubes forming the apertures.

RHABDAMMINA ABYSSORUM M. Sars.

(Plate 12, fig. 2.)

Test free, radiate, most commonly with three rays in the same plane, but occasionally with four or five or more rays sometimes projecting irregularly from the central body; walls thin; central chamber small; the tubular arms terminating in simple rounded apertures. The specimens exhibited are below the average in size, but were selected for convenience of mounting. Section shows the form of the cavity, and thickness of the walls.

Locality.—Gulf of Mexico (station 2383), 1,181 fathoms.

RHABDAMMINA DISCRETA Brady.

(Plate 13.)

Test in the form of a long, straight cylinder, slightly constricted at irregular intervals and open at both ends; cavity smooth; walls rather thin, constructed of coarse sand firmly cemented. Sometimes reaches a length of an inch or more.

Locality.—Off Chesapeake Bay (station 2731), 781 fathoms.

RHABDAMMINA LINEARIS Brady.

(Plate 14, fig. 1.)

Test free, long, straight or slightly bent, cylindrical, having an oval, inflated central chamber with two long arms projecting in opposite directions on the same line; tubular portion slightly tapering; walls vary in texture from very fine sand mixed with sponge-spicules to quite coarse angular sand-grains; cavity corresponds to the outward form of the test; apertures simple, one at each end. Length, 3 to 12 mm. ($\frac{1}{8}$ to $\frac{1}{2}$ inch).

Localities.—Off Georges Bank, and off the coast of Brazil (stations 2570, 2760), 1,019 and 1,813 fathoms.

RHABDAMMINA CORNUTA Brady.

(Plate 14, fig. 2.)

Test free, asymmetrical, consisting of an inflated chamber of irregular contour, and numerous short arms radiating from the surface; walls thin, composed of a single layer of rather coarse grains of white sand,

sometimes mixed with sponge spicules, firmly united by a brown cement substance: arms tubular, terminating in simple rounded apertures.

Localities.—North Atlantic, and the Caribbean Sea (stations 2115, 2150, 2234, 2571), 380 to 1,350 fathoms.

Genus RHIZAMMINA.

Unattached masses of fine, flexible, simple or branching chitino-arenaceous tubes.

RHIZAMMINA INDIVISA Brady.

(Plate 15, fig. 2.)

Slender, flexible, simple, chitinous tubes of a brownish color, thickly incrusted with small foraminifera (mostly Globigerina) and very fine sand. Test more or less contorted in drying; generally tapering toward the extremities: apertures terminal, simple. Length, 3 to 6 mm. ($\frac{1}{8}$ to $\frac{1}{4}$ inch).

Localities.—Southward of Long Island, the Straits of Yucatan, the Gulf of Mexico, and the coast of Brazil (stations 2234, 2355, 2380, 2760), 400 to 1,400 fathoms.

RHIZAMMINA ALGÆFORMIS Brady.

(Plate 15, fig. 1.)

Slender, chitinous tubes, incrusted with fine sand or small foraminifera; dichotomously branched; quite flexible while wet, very brittle when dry; found in tangled masses, from which it is extremely difficult to separate an unbroken specimen. Length, indefinite; may be an inch or more; diameter of tube, 0.12 to 0.3 mm. ($\frac{1}{200}$ to $\frac{1}{80}$ inch).

Locality.—Off the west coast of Mexico (station 3415), 1879 fathoms.

Family III. LITUOLIDÆ.

Test arenaceous, usually regular in contour and more or less definitely segmented; chambers frequently labyrinthic.

Subfamily LITUOLINÆ.

Test composed of coarse sand grains, rough externally; often labyrinthic.

Genus REOPHAX.

Test free: composed of a single flask-shaped chamber, or of several united in a straight, curved, or irregular line; never spiral.

REOPHAX DIFFLUGIFORMIS Brady.

(Plate 16, fig. 2.)

Test free, small, oval, pyriform, or flask-shaped; walls thin, inclosing a single undivided chamber, and composed of rather coarse sand firmly

cemented; aperture a single, simple, round opening. Length, 0.35 to 0.75 mm. ($\frac{1}{70}$ to $\frac{1}{32}$ inch).

Localities.—Cape Hatteras, in the Gulf of Mexico, and off New York (stations 2115, 2377, 2394, 2530, 2550, 2584), 400 to 1,000 fathoms.

REOPHAX DIFFLUGIFORMIS Brady, variety TESTACEA, new.

(Plate 16, fig. 1.)

Identical with the preceding, except that the test is much larger and composed entirely of small empty sheils of foraminifera. Section shows the undivided chamber and the walls constructed of a single layer of shells.

Locality.—Southward of Long Island (station 2231), 810 fathoms.

REOPHAX SCORPIURUS Montfort.

(Plates 16, fig. 3; 17, fig. 1.)

Consists of a series of segments, few in number, irregular in shape, joined in a more or less curved or crooked line. The walls may be composed entirely of sand or of the shells of foraminifera, or in part of each.

Localities.—Off Marthas Vineyard, and southeast of Georges Bank (stations 2221, 2570), 1,525 and 1,813 fathoms.

REOPHAX BILOCULARIS, new species.

(Plate 17, fig. 2.)

Composed of two segments united end to end in a straight or curved line; primary segment oval, ovate, or cylindrical, constricted at the junction with the final segment, which is ovate, inflated, and terminates in a tubular neck with a round orifice; walls composed of a single layer of shells of dead foraminifera, both small and large, mixed with fine sand; surface often very irregular when large shells are built into the walls. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

This seems to be an intermediate form between *R. difflugiformis* and *R. scorpiurus.* Goës[1] figures a similar specimen under the name *R. nodulosus pygmaeus*, but another specimen under the same name is figured having five segments. No example having more than two segments has been found among the hundreds taken from material dredged off Cape Fear (station 2679), 782 fathoms.

REOPHAX PILULIFERA Brady.

(Plate 18, fig. 1.)

Segments three to five, inflated, rapidly increasing in size from the first, forming a conical curved test; walls composed of coarse sand, rough; color, brown; aperture simple, terminal. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Off Bahia, Brazil (station 2760), 1,019 fathoms.

[1] Arct. and Scand. Foram.

REOPHAX DENTALINIFORMIS Brady.

(Plate 18, fig. 2.)

Test cylindrical, tapering, slightly curved, made up of four to six elongate, slightly inflated segments arranged in linear series. Walls composed of rather coarse sand, firmly cemented; aperture in the prolonged end of the terminal segment. Length, 1.5 to 3 mm. ($\frac{1}{16}$ to $\frac{1}{8}$ inch).

Locality.—Not recorded.

REOPHAX BACILLARIS Brady.

(Plate 18, fig. 3.)

Long, slender, cylindrical, straight or slightly bent, tapering gradually, composed of numerous segments (fifteen to twenty); sutures between the earliest segments indistinguishable, the later segments inflated and the sutures well marked; aperture simple, in the terminal segment; color, light gray. Length, 1.5 to 3 mm. ($\frac{1}{16}$ to $\frac{1}{8}$ inch).

Localities.—Nantucket Shoals, off Trinidad, south of Cuba, southeast of Marthas Vineyard, off Chesapeake Bay (stations 2041, 2221, 2228, 2568, 2723), 1,500 to 1,800 fathoms.

REOPHAX NODULOSA Brady.

(Plate 18, fig. 4.)

A long, cylindrical, tapering, straight or slightly bent test, composed of several (commonly six to ten) oblong or pyriform segments, arranged in linear series, slightly embracing; walls thin, arenaceous, smooth within and without; color, a rich brown; aperture simple, terminal. Section shows the smooth chambers and the thin embracing walls.

Locality.—Gulf of Mexico (stations 2385, 2395), 730 and 347 fathoms.

REOPHAX ADUNCA Brady.

(Plate 18, fig. 5.)

The distinguishing characteristics of this species are the inflated segments, their nearly equal diameter, and their irregular arrangement in a crooked line of succession. It is of smaller size and coarser structure than the other polythalamous species of Reophax.

Localities.—Off coast of Maryland and in Gulf of Mexico (stations 2228, 2338), 1,582 and 189 fathoms.

REOPHAX CYLINDRICA Brady.

(Plate 18, fig. 6.)

Elongate, straight, cylindrical, of nearly even diameter, closed and rounded at the aboral end, constricted at the oral extremity; sutures marking the union of segments almost wholly obscured; aperture simple, central, terminal; chambers regular in form, separated by thick,

flat septal plates. Length, about 2.5 mm. ($\frac{1}{10}$ inch); diameter, 0.4 mm. ($\frac{1}{60}$ inch).

Locality.—A single specimen obtained about 200 miles southeast of Marthas Vineyard (station 2568), 1,781 fathoms.

Genus HAPLOPHRAGMIUM.

Test free; partially or entirely spiral; nautiloid or crosier shaped; chambers numerous, not labyrinthic.

HAPLOPHRAGMIUM AGGLUTINANS d'Orbigny.

(Plate 19, fig. 2.)

Commences as a small, flat spiral of little more than a single convolution; continues as a straight series of cylindrical segments, gradually increasing in size; walls constructed of more or less coarse sand; surface rough, sutural lines indistinct; aperture central at the end of the final segment. Section shows form and arrangement of chambers.

Localities.—North Atlantic and Gulf of Mexico (stations 2041, 2115, 2385, 2374, 2568, 2576, 2679), 18 to 1,700 fathoms.

HAPLOPHRAGMIUM CALCAREUM Brady.

(Plate 19, fig. 1.)

A large, coarse, compressed, falciform shell, with a short spiral portion and a more or less extended straight part, composed of two to six well defined, broad segments; walls constructed of rather coarse coral sand neatly joined and firmly cemented; aperture simple, terminal. Length, about 3 mm. ($\frac{1}{8}$ inch).

Locality.—Arrowsmith Bank, Straits of Yucatan (station 2355), 399 fathoms.

HAPLOPHRAGMIUM TENUIMARGO Brady.

(Plate 19, fig. 3.)

Test small, much compressed, the edges thin and jagged; segmentation obscure, early arrangement spiral, later rectilinear; walls of coarse sand; surface rough; aperture simple, terminal. Length, 0.75 to 1.5 mm. ($\frac{1}{32}$ to $\frac{1}{16}$ inch).

Localities.—Off Cape Hatteras and off Block Island (stations 2115, 2584), 843 and 541 fathoms.

HAPLOPHRAGMIUM CASSIS Parker.

(Plate 19, fig. 4.)

Small, compressed, somewhat sigmoidal in outline, the edges rounded; segmentation obscure, early arrangement spiral, later arrangement linear, but the segments becoming broader and more and more diagonally placed; walls of coarse sand, but the surface comparatively

smooth; color light gray; aperture at the end of the final segment. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Portland, Maine, 4 to 5 fathoms.

HAPLOPHRAGMIUM FOLIACEUM Brady.

(Plate 19, fig. 6.)

Flat on both sides and extremely thin, the early spiral convolutions quite distinct, the rectilinear segments broad and with sutural lines evident; walls smooth and built of rather coarse sand; color reddish-brown; aperture a terminal slit. Length, about 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—Gulf of Mexico and off Marthas Vineyard (stations 2377, 2568), 210 and 1,781 fathoms.

HAPLOPHRAGMIUM EMACIATUM Brady.

(Plate 19, fig. 5.)

Thin, flat, nearly circular in outline, consisting of about two convolutions made up of numerous segments; lines of union of the segments more or less indistinct; walls composed of sand, or of sand and sponge spicules mixed, or sometimes almost wholly of broken sponge spicules arranged in an orderly manner parallel to the spiral axis of growth; color brown; aperture a transverse arched slit at the base of the final segment. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—West coast of Cuba, and off coast of Brazil, (stations 2352, 2760), 463 and 1,019 fathoms.

HAPLOPHRAGMIUM LATIDORSATUM Bornemann.

(Plate 20, fig. 1.)

A simple planospiral shell of about three convolutions, the segments rapidly increasing in size, the final convolution completely inclosing the others. Contour subglobular, septal lines distinct; aperture a slightly irregular transverse slit at the base of the final segment, with thin, well-formed lips; color grayish-brown. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch). Section shows the arrangement of chambers, and the thick, rather coarsely arenaceous walls.

Localities.—Off Nantucket Shoals and Gulf of Mexico (stations 2041, 2352, 2385, 2586), 300 to 1,600 fathoms.

HAPLOPHRAGMIUM SCITULUM Brady.

(Plate 20, fig. 2.)

A planospiral shell of about three convolutions, somewhat flattened on both sides, depressed at the center, the outer convolution more or less completely concealing the others; walls composed of rather fine sand, firmly and smoothly joined; color light brown; aperture as in *H. latidorsatum*. Diameter, about 0.625 mm. ($\frac{1}{40}$ inch). Section shows thin walls, and series of chambers in three convolutions.

Localities.—West coast of Cuba, south of Black Island, west coast of Patagonia, (stations 2352, 2584, 2784, 3080), 93 to 541 fathoms.

HAPLOPHRAGMIUM CANARIENSE d'Orbigny.

(Plate 20, fig. 3.)

Planospiral, much compressed, especially the earlier convolutions, the segments of the final convolution more or less inflated; structure coarsely arenaceous; surface rough; color reddish to grayish-brown; aperture a short transverse slit, with thin projecting lips, situated near the inner margin of the last segment. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—Off Nantucket shoals, south of Black Island, and coast of Oregon (stations 2251, 2584, 3080), 43 to 540 fathoms.

HAPLOPHRAGMIUM GLOBIGERINIFORME Parker and Jones.

(Plate 21, fig. 1.)

Has the same form as *Globigerina bulloides*, being composed of a series of gradually enlarging segments arranged spirally around a perpendicular axis, all the segments being visible on one face of the shell, and only the final convolution on the other. Walls composed of rather coarse sand, firmly and neatly cemented; color brown; aperture at the central margin of the final convolution. Size very variable.

Localities.—Off Nantucket Shoals, off Cape Hatteras, southeast of Marthas Vineyard, off coast of Brazil (stations 2041, 2115, 2568, 2760), 840 to 1,780 fathoms.

Genus HAPLOSTICHE.

Test free, uniserial, straight or arcuate; never spiral; chambers labyrinthic.

HAPLOSTICHE SOLDANII Jones and Parker.

(Plate 21, fig. 3.)

Elongate, cylindrical or tapering, rounded at the extremities, consisting of several (five to ten) chambers arranged in linear series; segments slightly embracing, lines of union indistinct; texture coarsely arenaceous; color light-gray; chambers subdivided by secondary septa; aperture porous or branched. Length, about 3 mm. ($\frac{1}{8}$ inch). Section shows the structure of the walls, the arrangement of the chambers and their labyrinthic character.

Localities.—Gulf of Mexico (stations 2377, 2399), 210 and 196 fathoms.

Subfamily TROCHAMMININÆ.

Test thin, composed of minute sand grains incorporated with calcareous or other inorganic cement, or embedded in a chitinous membrane; exterior smooth, often polished; interior smooth or (rarely) reticulated, never labyrinthic.

Genus THURAMMINA.

Test typically consisting of a single Orbulina-like chamber with several mammillate apertures.

THURAMMINA PAPILLATA Brady.

(Plate 22, fig. 1.)

Test spherical, with very thin walls constructed of fine sand grains firmly and smoothly cemented, inclosing a single undivided chamber. The surface is studded with more or less numerous nipple-like processes, each of which terminates in a simple aperture; color, various shades of brown. Diameter, 0.6 to 1.5 mm. ($\frac{1}{40}$ to $\frac{1}{16}$ inch).

Localities.—South of Long Island, Gulf of Mexico, southeast Georges Bank, coast of Brazil (stations 2225, 2383, 2385, 2570, 2760), 730 to 2,512 fathoms.

THURAMMINA FAVOSA new species.

(Plate 21, fig. 2.)

Test spherical; walls very thin, arenaceous, brown; surface ornamented with a network of thin prominent ridges extending uniformly over the whole test, forming hexagonal pits; cavity smooth; apertures numerous, small, at the end of short tubular processes from some of the points of junction of the ridges. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Gulf of Mexico (stations 2374, 2394), 26 and 420 fathoms.

THURAMMINA CARIOSA new species.

(Plate 22, fig. 2.)

Spherical; surface rough, as if eroded; walls rather thick, cavernous; cavity globular, smooth; apertures not tubular; color a dirty brown. Differs from *T. favosa* in the thicker walls and coarser structure, the eroded rather than reticulated surface, the cavernous walls, and the nontubular orifices. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Gulf of Mexico (stations 2385, 2394), 420 and 730 fathoms.

Genus AMMODISCUS.

Test free, formed of a tube coiled upon itself in various ways; sometimes constricted at intervals, never truly septate.

AMMODISCUS INCERTUS d'Orbigny.

(Plate 23, fig. 2.)

A thin disk, concave on both faces, composed of numerous convolutions of a narrow, nonseptate tube, whose diameter increases very gradually from beginning to end; walls arenaceous, smooth; color in various shades of brown; aperture the unconstricted end of the tube.

Section shows a simple tube, without initial globular cavity, coiled upon itself in about twenty convolutions. Diameter, 0.75 to 3 mm. ($\frac{1}{35}$ to $\frac{1}{8}$ inch).

Localities.—Off coast of Maryland, south of Marthas Vineyard. Gulf of Mexico, coast of Brazil (stations 2171, 2243, 2383, 2385, 2586, 2760), 63 to 1,180 fathoms.

AMMODISCUS TENUIS Brady.

(Plate 23, fig. 1.)

A flattened disk, slightly, if at all, concave on the two faces, formed of a simple unconstricted tube of nearly uniform diameter coiled upon itself, each convolution slightly embracing the preceding. Differs from the last described species chiefly in the uniform size of the tube, and in the smaller number of convolutions. Diameter, about 2 mm. ($\frac{1}{12}$ inch).

Localities.—Off Cape Hatteras, off Nantucket Shoals, Gulf of Mexico, Panama Bay (stations 2115, 2352, 2385, 2395, 2805), 50 to 850 fathoms.

AMMODISCUS GORDIALIS Jones and Parker.

(Plate 24, fig. 1.)

Small, unsymmetrical in form, most often imperfectly lenticular; formed of a single tube of nearly uniform diameter coiled upon itself in varying directions. The degree of variation from the flat spiral differs with each specimen. Color light brown. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Localities.—Off Nantucket Shoals, southeast of Marthas Vineyard, and off coast of Oregon (stations 2041, 2568, 3080), 100 to 1,800 fathoms.

AMMODISCUS CHAROIDES Jones and Parker.

(Plate 24, fig. 2.)

Small, subglobular, formed of a narrow tube of uniform diameter coiled regularly in a series of superimposed layers, often terminating in a partial or complete convolution wound around the globular coil in a rectangular or diagonal direction; color brown; surface smooth and polished; aperture the open end of the tube. Diameter, 0.4 mm. ($\frac{1}{60}$ inch).

Localities.—Off Nantucket Shoals and coast of Oregon (stations 2041, 3080), 90 and 1,600 fathoms.

Genus WEBBINA.

Test adherent; consisting either of a single tent-like chamber, or of a number of such chambers connected by adherent stoloniferous tubes.

WEBBINA CLAVATA Jones and Parker.

(Plate 24, fig. 3.)

Test consists of either (1) the half of an oval or pear-shaped chamber, adherent to a bit of shell or other object which closes the flat side of the chamber, with a tubular prolongation of indefinite length also

adherent and incomplete; or of (2) a tube closed and inflated at one end, into the walls of which are built on all sides small foraminifera at rather close and irregular intervals. Texture finely arenaceous; color brown; aperture simple, terminal.

Locality.—Gulf of Mexico (stations 2352, 2385), 463 and 730 fathoms.

Genus HORMOSINA.

Test consisting of a single rounded chamber, or, more usually, of several chambers in a single straight or arcuate series.

HORMOSINA GLOBULIFERA Brady.

(Plate 24, fig. 4.)

Consists of a single spherical chamber, or of several chambers (two to six), gradually increasing in size, and joined in a straight or slightly curved series; walls thin, of fine sand, neatly built, aperture simple at the end of a narrow tubular neck which terminates the final segment; color varies from white to reddish brown. Section shows the globular chambers, the thin walls, and the aperture leading to each successive chamber.

Localities.—Southeast of Georges Bank, and off coast of Brazil (stations 2530, 2570, 2760), 950 to 1,800 fathoms.

HORMOSINA OVICULA Brady.

(Plate 25, fig. 2.)

Orbicular, oval, or pyriform segments, each having a more or less prolonged tubular neck, the segments arranged in a rectilinear series. Walls finely arenaceous, often rough externally with projecting sponge spicules incorporated with the sand. Length, 6 mm. ($\frac{1}{4}$ inch) or less.

Localities.—Gulf of Mexico and Atlantic off Cape Fear (stations 2383, 2399, 2677), 200 to 1,200 fathoms.

HORMOSINA CARPENTERI Brady.

(Plate 25, fig. 1.)

Pear-shaped segments, usually with a prolonged neck, nearly uniform in size, arranged in a curved or crooked series of indefinite length; walls finely arenaceous, firmly and smoothly cemented; aperture simple, terminal; color light brown. Section shows the thickness and structure of the walls, and the form of the chambers.

Locality.—Gulf of Mexico (stations 2382, 2383, 2385, 2398, 2400), 169 to 1,255 fathoms.

Genus TROCHAMMINA.

Test free or rarely adherent, rotaliform, nautiloid, or trochoid; more or less distinctly septate.

TROCHAMMINA PROTEUS Karrer.

(Plate 25, fig. 3.)

Test formed of a continuous tube, increasing slightly in diameter from the beginning, constricted at frequent and irregular intervals, coiled into the form of a disk, the convolutions being nearly in the same plane, or sometimes contorted into irregular forms. Diameter, 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—Off west coast of Cuba, coast of Yucatan, Gulf of Mexico, Windward Islands, and coast of Brazil (stations 2352, 2355, 2394, 2750, 2760), 400 to 1,000 fathoms.

TROCHAMMINA LITUIFORMIS Brady.

(Plate 26, fig. 1.)

Consists of a simple tube, constricted at irregular intervals, coiled upon itself at the beginning either in planospiral convolutions or irregularly, subsequently becoming linear and more or less bent or contorted; surface smooth, color light brown; aperture terminal. Length, 5 mm. ($\frac{1}{5}$ inch) or less.

Localities.—Gulf of Mexico and coast of Brazil (stations 2352, 2394, 2395, 2760), 350 to 1,000 fathoms.

TROCHAMMINA CORONATA Brady.

(Plate 26, fig. 3.)

Test large, thick, biconcave, composed of numerous inflated segments arranged in a close spiral of three or more convolutions; walls distinctly arenaceous, even, but not smooth; sutures depressed; color pale brown or buff; aperture simple, terminal. Diameter, about 2 mm. ($\frac{1}{12}$ inch).

Locality.—Gulf of Mexico (station 2395), 347 fathoms.

TROCHAMMINA CONGLOBATA Brady.

(Plate 26, fig. 2.)

A tumid, subglobular shell, formed of a thin, irregularly segmented tube coiled upon itself in a constantly varying plane; segments much inflated, often transversely wrinkled; aperture the open, slightly constricted end of the tube; color brownish white. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Gulf of Mexico (station 2395), 347 fathoms.

TROCHAMMINA RINGENS Brady.

(Plate 27, fig. 1.)

Test nautiloid, composed of a series of segments, rather rapidly increasing in size, arranged in planspiral convolutions, the final whorl completely inclosing the previous ones; contour ovoid, compressed,

equally convex on both faces; outer edge rather sharp; septal lines quite distinct; aperture a transverse slit across the inner margin of the final segment; color brown; surface polished. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch.)

Localities.—Off coast of Maryland, Gulf of Mexico, southeast of Marthas Vineyard, coast of California, (stations 2228, 2385, 2394, 2568, 2923), 400 to 1,800 fathoms.

TROCHAMMINA PAUCILOCULATA Brady.

(Plate 27, fig. 2.)

Very small, ovoid, slightly compressed, on the flattened sides usually exposing four segments, three of which belong to the final convolution; sutures depressed; walls thin, constructed of very fine sand; surface polished, brown; aperture a short curved slit on the side and near the margin of the last segment. Length, about 0.5 mm. ($\frac{1}{50}$ inch).

Localities.—Off coast of South Carolina and southeast of Marthas Vineyard (stations 2313, 2568), 99 and 1,781 fathoms.

Subfamily LOFTUSINÆ.

Test of relatively large size, lenticular, spherical, or fusiform; constructed either on a spiral plan or in concentric layers, the chamber cavities occupied to a large extent by the excessive development of the finely arenaceous cancellated walls.

Genus CYCLAMMINA.

Test spiral, nautiloid; lenticular or subglobular; smooth externally; chambers numerous, involute.

CYCLAMMINA CANCELLATA Brady.

(Plates 27, fig. 3; 28, fig 1.)

Large, nautiloid, composed of numerous segments arranged planospirally in about four convolutions, the last of which completely incloses the others; sutural lines well marked, generally wavy; surface smooth; aperture a crescent-shaped fissure at the junction of the final segment with the preceding convolution; face of the final segment porous. Section shows the arenaceous walls and their cancellated structure, the cavities in the walls communicating freely with the chambers.

Localities.—Gulf of Mexico, south of Long Island, west coast of Patagonia, coast of British Columbia (stations 2385, 2394, 2584, 2784, 2860), 420 to 876 fathoms.

CYCLAMMINA PUSILLA Brady.

(Plate 28, fig. 2.)

Differs from the last described species chiefly in its smaller size and thinner and less conspicuously cancellated walls. Section shows both these characters. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Off coast of Oregon (station 3080), 93 fathoms.

Family IV. TEXTULARIDÆ.

Tests of the larger species arenaceous, either with or without a perforate calcareous basis; smaller forms hyaline and conspicuously perforated. Chambers arranged in two or more alternating series, or spiral, or confused; often dimorphous.

Subfamily TEXTULARINÆ.

Typically bi- or tri-serial; often bi-, rarely tri-morphous.

Genus TEXTULARIA.

Segments in two rows, alternating with each other: normal aperture an arched slit at the base of the inner wall of the final segment.

TEXTULARIA QUADRILATERA Schwager.

(Plate 28, fig. 3.)

Elongate, compressed, tapering, quadrilateral, the two broader faces concave, the angles prominent and sharp, both ends rounded; made up of a double alternating series of segments to the number of seven, more or less, in each row; aperture simple, near the base of the last segment; structure hyaline and minutely perforate. Length, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Specimens taken near Aspinwall, Isthmus of Panama (station 2144), 896 fathoms.

TEXTULARIA TRANSVERSARIA Brady.

(Plate 28, fig. 4.)

Elongate, compressed, tapering, the broad faces convex, the angles thin; composed of a double row of chambers placed transversely to the long axis of the shell, many of them open at the peripheral end, giving a serrated appearance to the edge of the test. Length, about 0.75 mm. ($\frac{1}{33}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

TEXTULARIA CONCAVA Karrer.

(Plate 28, fig. 5.)

Short, compressed, rapidly tapering, lateral faces flattened or concave, edges either square or rounded, angles full or rounded; texture rather roughly arenaceous; aperture a transverse arched slit with slightly protruding lips at the inner margin of the last segment. Length, about 1 mm. ($\frac{1}{25}$ inch). Readily distinguished from *T. quadrilatera* by the arenaceous texture of its walls.

Localities.—Off the island of Old Providence and off Carysfort, Florida (stations 2150, 2641), 382 and 60 fathoms.

TEXTULARIA CARINATA d'Orbigny.

(Plate 29, fig. 1.)

Short, triangular, compressed, the broad faces divided by a prominent ridge extending from the base toward the apex, the sutures strongly ribbed, the marginal angles acute, with irregular, short, rounded teeth, base quadrilateral, apex thin and slightly rounded; aperture a broad slit at the inner margin of the final segment; texture coarsely arenaceous. Length, 1.4 mm. ($\frac{1}{18}$ inch).

Locality.—Gulf of Mexico (station 2400), 169 fathoms.

TEXTULARIA RUGOSA Reuss.

(Plate 29, fig. 2.)

Pyramidal, with nearly equal sides, the angles rugged; segments rather thin, quadrangular, curved upon the flat, projecting at the sides and angles; sutural lines deep and arched. Length, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Specimen collected near the mouth of Exuma Sound, Bahamas (station 2629), 1,169 fathoms.

TEXTULARIA AGGLUTINANS d'Orbigny.

(Plate 29, fig. 4.)

Elongated, tapering, slightly flattened, composed of twenty segments, more or less, alternating in two rows, the later segments slightly inflated; texture rather coarsely arenaceous; aperture a smooth curved fissure on the inner side of the last segment. Length, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—Near Aspinwall, Straits of Yucatan, Gulf of Mexico, coast of Brazil (stations 2144, 2358, 2385, 2760), 222 to 1,019 fathoms.

TEXTULARIA LUCULENTA Brady.

(Plate 29, fig. 3.)

Elongate, tapering, flattened; edges rounded; segments numerous; texture finely arenaceous. Length, about 2 mm. ($\frac{1}{12}$ inch).

Localities.—Near Old Providence, off Key West, Arrowsmith Bank (Yucatan) (stations 2150, 2315, 2355), 37 to 400 fathoms.

TEXTULARIA GRAMEN d'Orbigny.

(Plate 29, fig. 5.)

Subconical, compressed toward the tip, broadly oval at the base, angles of the compressed portion rounded; sutural lines indistinct; texture arenaceous, surface rough; aperture round or lengthened at the inner margin of the last segment. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—Caribbean Sea and Gulf of Mexico (stations 2150, 2400), 382 and 169 fathoms.

TEXTULARIA CONICA d'Orbigny.

(Plate 29, fig. 6.)

Small, short, conical, often a little compressed laterally, base quite flat; texture arenaceous; surface rough. Length, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

TEXTULARIA TROCHUS d'Orbigny.

(Plate 30, fig. 1.)

Short, conical, with a flat base and a rounded tip, in section circular both at the tip and base; walls thick and cavernous; texture rather coarsely arenaceous; aperture a narrow slit with smooth lips at the inner margin of the last segment. Length, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—Off Cape Hatteras, west coast of Cuba, east coast of Florida (stations 2264, 2352, 2641), 60 to 460 fathoms.

TEXTULARIA BARRETTII Jones and Parker.

(Plate 30, fig. 2.)

A large, symmetrical, elongated, conical shell, slightly compressed antero-posteriorly instead of laterally as in other species of this genus; texture arenaceous; surface smooth; sutures distinctly marked by narrow grooves; chamber cavities labyrinthic. Sections show the labyrinthic character of the chambers and the thick walls. Length, 4 mm. ($\frac{1}{6}$ inch), more or less.

Locality.—Off Little Bahama Bank (station 2655), 338 fathoms.

Genus VERNEUILINA.

Test triserial, with textularian aperture.

VERNEUILINA PYGMÆA Egger.

(Plate 31, fig. 1.)

A short, conical test, composed of three series of segments arranged symmetrically around the long axis of the shell; segments inflated; walls finely arenaceous, smooth; aperture a long slit, with a slightly raised lower lip, at the inner margin of the final segment; color white. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Gulf of Mexico (stations 2383, 2395), 1,181 and 347 fathoms.

VERNEUILINA PROPINQUA Brady.

(Plate 31, fig. 2.)

Very similar in form to *V. pygmæa*, but is larger, coarser, rougher, less symmetrical, and in color a reddish brown. The aperture is without the raised lip seen in the other species.

Localities.—Specimens from four stations in the North Atlantic, one in South Atlantic, and two in the Gulf of Mexico (stations 2040, 2228, 2383, 2385, 2570, 2679, 2760), 730 to 2,226 fathoms.

Genus VALVULINA.

Test spiral, typically triserial, with three segments or rarely more in each convolution; free or adherent; aperture partially covered by a valvular lip.

VALVULINA CONICA Parker and Jones.

(Plate 31, fig. 3.)

Free or attached, short, conical; base broad and excavated; color brown, generally darker toward the apex; texture arenaceous; surface smooth; aperture at the inner margin of the terminal segment. One specimen shown is parasitic upon a fragment of *Rhabdammina;* the base of the attached *Valvulina* is surrounded by a border of fine white sand.

Localities.—Off Cape Hatteras, and south of Block Island (stations 2115, 2584), 843 and 541 fathoms.

Genus BIGENERINA.

Early chambers Textularian, later chambers uniserial and rectilinear.

BIGENERINA NODOSARIA d'Orbigny.

(Plate 31, fig. 4.)

The earlier segments, increasing rapidly in size, are arranged in two alternating series, forming the triangular flattened portion of the test, the remainder of the test is composed of three or four segments in a single straight series; aperture at the end of the final segment; texture coarsely arenaceous; surface rough. Length, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

BIGENERINA ROBUSTA Brady.

(Plate 32, fig. 1.)

Test large, coarse, elongate, cylindrical, tapering slightly toward the initial end; textularian segments numerous, forming the greater part of the test; nodosarian segments few, sometimes irregular; aperture central in the final segment. Diameter, 2.5 mm. ($\frac{1}{10}$ inch) or more.

Locality.—Old Providence Island (station 2150), 382 fathoms.

BIGENERINA CAPREOLUS d'Orbigny.

(Plate 32, fig. 3.)

A rather stout, coarse shell, the earlier portion resembling *Textularia carinata*, upon which rests two or three broad compressed segments in single series. Length, 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Off coast of Georgia (station 2416), 276 fathoms.

BIGENERINA PENNATULA Batsch.

(Plate 32, fig. 2.)

Oblong, rounded at both ends, differing from *B. capreolus* only in the more arching form of the textularian segments, and the greater number (four or five) of segments in the linear series.

Locality.—Old Providence Island (station 2150), 382 fathoms.

Genus GAUDRYINA.

Early segments triserial (Verneuiline); aperture either textularian or situated in a short terminal neck.

GAUDRYINA PUPOIDES d'Orbigny.

(Plate 32, fig. 4.)

A small, subconical, symmetrical shell, about one-fifth of its length at the apex being formed of segments arranged triserially, the remaining portion composed of slightly inflated segments in double, alternating series: structure calcareous; surface smooth; aperture at the inner margin of the final segment. Length, about 0.825 mm. ($\frac{1}{30}$ inch).

Localities.—Off Nantucket Shoals, and southeast of Marthas Vineyard (stations 2041, 2568), 1,608 and 1,781 fathoms.

GAUDRYINA BACCATA Schwager.

(Plate 32, fig. 5.)

Differs from *G. pupoides* in that it is larger, less symmetrical, and the segments more inflated. It is especially characterized by the tendency to distortion produced by the occasional unsymmetrical outgrowth of one or more segments. Length, about 2 mm. ($\frac{1}{12}$ inch).

Localities.—Off Nantucket Shoals, south of Marthas Vineyard, off Block Island (stations 2040, 2221, 2570, 2584, 2586), 328 to 2,226 fathoms.

GAUDRYINA SUBROTUNDATA Schwager.

(Plate 33, fig. 1.)

Subcylindrical, tapering at the initial end; sutures depressed; aperture central, near the inner margin of the final segment; texture variable, the smaller specimens being comparatively fine and smooth, the larger coarse and rough. Length, 1 to 5 mm. ($\frac{1}{25}$ to $\frac{1}{5}$ inch).

Localities.—Specimens have been preserved from eight stations in the North and South Atlantic and the Gulf of Mexico (stations 2150, 2385, 2394, 2400, 2679, 2751, 2760, 2763), 169 to 1,019 fathoms.

GAUDRYINA FILIFORMIS Berthelin.

(Plate 33, fig. 2.)

Long, slender, tapering, smooth, the triserial portion very short, the biserial chambers numerous and symmetrically arranged; sutures well marked. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Off west coast of Cuba (station 2352), 463 fathoms.

GAUDRYINA RUGOSA d'Orbigny.

(Plate 33, fig. 3.)

Elongate, triangular in section, the angles acute, triserial portion very short, biserial chambers alternately triangular and broadly quadrilateral in transverse section; structure coarsely arenaceous, compact. Length, 2 to 3 mm. ($\frac{1}{12}$ to $\frac{1}{8}$ inch). One specimen in the collection measures 4.5 mm. ($\frac{3}{16}$ inch).

Localities.—South of Marthas Vineyard and Gulf of Mexico (stations 2243, 2400), 63 and 169 fathoms.

GAUDRYINA SCABRA Brady.

(Plate 34, fig. 1.)

Resembles *G. pupoides* in form, but is larger, brown in color, coarsely arenaceous in texture, the sand sometimes mixed with sponge spicules; aperture a depressed slit at the inner margin of the last segment. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—Gulf of Mexico and west coast of Patagonia (stations 2352, 2385, 2784), 194 to 730 fathoms.

GAUDRYINA SIPHONELLA Reuss.

(Plate 34, fig. 2.)

Small, elongate, subcylindrical, occasionally distorted, the biserial segments numerous and somewhat inflated; aperture at the slightly projecting end of the final segment; color brown. Length, 0.5 to 0.8 mm. ($\frac{1}{50}$ to $\frac{1}{32}$ inch).

Locality.—Southeast of Marthas Vineyard (station 2568), 1,781 fathoms.

Genus CLAVULINA.

Early segments triserial, later ones uniserial and rectilinear; test generally either cylindrical or trifacial; aperture valvular.

CLAVULINA COMMUNIS d'Orbigny.

(Plate 34, fig. 3.)

Much elongated, cylindrical; the earliest portion triserial, conical, pointed, the remaining portion uniserial, straight, slightly depressed at the sutures; color, grayish-white; surface smooth or rough according as the walls are composed of fine or coarse calcareous sand; aperture round, at the end of a tubular projection from the final segment. Sections show the dimorphous character of the test, the thickness of walls, and the communication of the chambers. Length, from 2 to 5 mm. ($\frac{1}{12}$ to $\frac{1}{5}$ inch).

Localities.—North Atlantic, Gulf of Mexico, and Panama Bay (stations 2212, 2355, 2805), 50 to 425 fathoms.

CLAVULINA EOCÆNA Gümbel.

(Plate 35, fig. 1.)

Cylindrical or slightly tapering; triserial portion very short; nodosarian segments usually three or four in number, clearly defined by depressed sutures; walls coarsely arenaceous, rough; chambers partially divided by a network of incomplete septa springing from the outer wall; aperture a simple rounded orifice in a central slight depression at the end of the final segment. Section shows the apparent thickness of the walls due to the cancellar structure, and the form of the chambers. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Gulf of Mexico (station 2377), 210 fathoms.

CLAVULINA PARISIENSIS d'Orbigny.

(Plate 35, fig. 2.)

The distinguishing characteristic of this species is the triangular contour of the triserial portion of the test; otherwise it strongly resembles *C. communis*. It is somewhat coarser and rougher than the latter, and near the oral end the sutures are often much depressed.

Locality.—Gulf of Mexico (stations 2315, 2377, 2385, 2400), 37 to 730 fathoms.

A variety collected near Key West, Florida, has a very rough test constructed of coral sand. (Plate 35, fig. 3.)

CLAVULINA PARISIENSIS, variety HUMILIS Brady.

(Plate 36, fig. 1.)

The variation consists in its smaller size, rougher exterior, the deep depression of the sutures, often forming a distinct neck between the two last segments, and the aperture borne at the end of a long tubular prolongation of the final segment.

Localities.—Gulf of Mexico, and off the coast of Brazil (stations 2377, 2399, 2400, 2762), 59 to 210 fathoms.

CLAVULINA ANGULARIS d'Orbigny.

(Plate 36, fig. 2.)

Arrangement of segments as in other species of *Clavulina*, triserial at first, then uniserial and rectilinear. Differs from the other species in the triangular contour of transverse section of the uniserial as well as the triserial portion of the test; aperture a central arched slit with a protruding lower lip.

Locality.—Straits of Yucatan (station 2358), 222 fathoms.

Subfamily BULIMININÆ.

Typically spiral; weaker forms more or less regularly biserial; aperture oblique, comma-shaped or some modification of that form.

Genus BULIMINA.

Test spiral, elongate, more or less tapering; often triserial.

BULIMINA ELEGANS d'Orbigny.

(Plate 36, fig. 3.)

Very small, slender, elongate, tapering to a spinous point, more or less compressed on three sides; segments numerous, a little inflated, arranged in three longitudinal rows; aperture on the oblique face of the final segment; walls very thin and transparent and finely perforated. Length, about 0.75 mm. ($\frac{1}{32}$ inch).

Locality.—Off Block Island (station 2584), 541 fathoms.

BULIMINA PYRULA d'Orbigny.

(Plate 36, figs. 4, 5.)

Ovate, very slightly compressed, with exceedingly thin and transparent walls finely but distinctly perforated; segments erect and overlapping, the last three sometimes inclosing all the others; aperture in general ovate, but varying much in form, with a prominent overlapping lip. Length, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—South of Marthas Vineyard, Straits of Yucatan, Gulf of Mexico, west coast of Patagonia (stations 2212, 2352, 2383, 2571, 2784), 194 to 1,356 fathoms.

BULIMINA PYRULA, variety SPINESCENS Brady.

(Plate 37, fig. 1.)

In form and general characters identical with *B. pyrula*, but varies from the latter in that the base or aboral end is beset with more or less numerous short spines.

Locality.—Off the mouth of Chesapeake Bay (station 2263), 430 fathoms.

BULIMINA AFFINIS d'Orbigny.

(Plate 37, fig. 2.)

Test ovate; segments short and inflated, the later ones covering more of the end and less of the sides of the test than in *B. pyrula*. The specimens in hand have a brownish tinge, excepting the final segment, which is white.

Locality.—Collected in the channel between Patagonia and Wellington Island (station 2784), 194 fathoms.

BULIMINA PUPOIDES d'Orbigny.

(Plate 37, fig. 3.)

Oval or ovate, with short segments but slightly inflated, the whole test rather conspicuously resembling the pupa of certain insects.

Locality.—Gulf of Mexico (station 2394), 420 fathoms.

BULIMINA ACULEATA d'Orbigny.

(Plate 37, fig. 4.)

Short, conical, triserial, slightly compressed on three sides, segments somewhat inflated, the earlier ones bearing long slender spines, the later ones sometimes smooth, sometimes with short spines or slight protuberances.

Localities.—Near Aspinwall, Gulf of Mexico, southeast of Georges Bank, coast of Brazil (stations 2144, 2377, 2392, 2394, 2530, 2763), 210 to 956 fathoms.

BULIMINA INFLATA Seguenza.

(Plate 37, fig. 5.)

Ovate, acuminate, the segments erect, short, and overlapping, the overlapping edges of the segments crimped and sharply serrate. Length, 0.4 mm. ($\frac{1}{60}$ inch).

Localities.—Gulf of Mexico, southeast of Georges Bank, south of Block Island (stations 2377, 2398, 2530, 2584), 210 to 956 fathoms.

Genus VIRGULINA.

Test much elongated, with a tendency to become asymmetrically biserial.

VIRGULINA SCHREIBERSIANA Czjzek.

(Plate 37, fig. 6.)

Elongate, subcylindrical, slightly compressed on two sides, tapering at both ends, extremities rounded, arrangement of segments irregularly biserial, giving a twisted appearance to the shell; aperture a vertical loop-shaped slit near the end of the last segment. Length, about 0.4 mm. ($\frac{1}{60}$ inch.)

Locality.—Collected off Chesapeake Bay (station 2263), 430 fathoms.

VIRGULINA SUBSQUAMOSA Egger.

(Plate 37, fig. 7.)

Elongate-oval, compressed, margins rounded; segments overlapping, slightly inflated, arranged in two inequilateral, alternating series; walls thin, tranparent, and finely perforated; aperture a loop-shaped slit in the face of the last segment. Length, about 0.7 mm. ($\frac{1}{35}$ inch).

Locality.—Gulf of Mexico (station 2377), 210 fathoms.

Genus BOLIVINA.

Test distinctly biserial, arrangement Textularian.

BOLIVINA ÆNARIENSIS Costa.

(Plate 37, fig. 8.)

Elongate, flattened, tapering, symmetrical; margins sharp and smooth; apex usually terminating in a spinous process; two or more delicate perpendicular ridges extending a variable distance from the apex toward the base; walls thin, transparent, minutely and profusely perforated; segments very regularly arranged in two alternating series; aperture loop-like at the inner margin of the last segment. Length, about 0.8 mm. ($\frac{1}{30}$ inch).

Localities.—Off Cape Hatteras, Gulf of Mexico, southeast of Georges Bank, south of Block Island (stations 2289, 2400, 2530, 2584), 7 to 956 fathoms.

BOLIVINA PUNCTATA d'Orbigny.

(Plate 38, fig. 1.)

Slender, elongate, tapering, rounded, symmetrical, slightly curved; composed of a double, alternating series of segments, twelve or more in each row; surface smooth and even; sutures not depressed; walls thin and finely perforated; aperture ovate, oblique, on the terminal face of the last segment. Length, about 0.8 mm. ($\frac{1}{32}$ inch).

Locality.—Not recorded.

BOLIVINA PORRECTA Brady.

(Plate 38, fig. 2.)

Straight, slightly tapering, nearly cylindrical in section; earlier segments in opposite alternating rows, later segments triangular and superposed, the sutures extending obliquely the whole breadth of the test; walls very thin, transparent and finely perforated; aperture large, oval, across the terminal face of the last segment. Length, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—A single specimen from the North Atlantic, southeast of Georges Bank (station 2530), 956 fathoms.

Subfamily CASSIDULININÆ.

Test consisting of a Textularia-like series of alternating segments, more or less coiled upon itself.

Genus CASSIDULINA.

Test biserial, folded on its long axis, and coiled more or less completely on itself.

CASSIDULINA CRASSA d'Orbigny.

(Plate 38, fig. 3.)

Oval, compressed, with rounded outlines; sutural lines indistinct; surface smooth; texture calcareous. Section shows the coiled chambers of one series. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Off head of Akutan Island, Alaska (station 2842), 72 fathoms.

CASSIDULINA SUBGLOBOSA Brady.

(Plate 38, fig. 4.)

Subglobular, the final segment slightly protruding, inequilateral, the segments being irregularly arranged; surface smooth; walls calcareous, imperfectly transparent, finely perforated; aperture an oval slit at the end of the last segment. Diameter, 0.8 mm. ($\frac{1}{30}$ inch).

Localities.—Gulf of Mexico, off Windward Islands, and Trinidad (stations 2383, 2751, 2754), 880 to 1,181 fathoms.

Family V. MILIOLIDÆ.

Test imperforate; normally calcareous and porcellanous, sometimes incrusted with sand.

Subfamily MILIOLININÆ.

Chambers two in each convolution, coiled on an elongated axis, either symmetrically in a single plane or inequilaterally. Aperture alternately at either end of the shell.

Genus BILOCULINA.

Chambers in a single plane, embracing; the last two only visible.

BILOCULINA BULLOIDES d'Orbigny.

(Plate 38, fig. 5.)

Oval, inflated, composed of a series of embracing segments applied alternately above and below the globular primordial chamber; walls thick, calcareous, soft; surface often incrusted with a thin layer of fine sand; aperture small, circular, on the more or less produced or tubular end of the last segment, usually bearing a small T-shaped valvular tooth. Length, about 1.25 mm. ($\frac{1}{20}$ inch). Transverse section shows the arrangement of the chambers.

Locality.—Off Havana, Cuba (station 2335), 204 fathoms.

BILOCULINA TUBULOSA Costa.

(Plate 39, fig. 1.)

In general characters like *B. bulloides*, except that the last two segments are separated by a deep groove on both sides. This groove may be so deep as to show the edge of the antepenultimate segment, and is often wider on one side than the other, so that the species passes by regular gradation into *Miliolina trigonula*. Length, 0.75 to 1.5 mm. ($\frac{1}{32}$ to $\frac{1}{16}$ inch).

Locality.—Specimens collected off the coast of Oregon (station 3080), 93 fathoms.

BILOCULINA RINGENS Lamarck.

(Plate 39, fig. 2.)

A stout, inflated, smooth, and polished shell, slightly compressed from above downward, nearly circular in outline when seen from above, the final segment projecting well beyond the preceding one, to which it is smoothly and firmly joined; aperture usually a broad slit with a nearly equally broad valvular lower lip. Diameter, 1.5 mm. ($\frac{1}{16}$ inch), more or less. Longitudinal section shows arrangement of chambers characteristic of the genus, and the apertures alternately at opposite ends of the shell.

Localities.—Off Cape Hatteras and in the Gulf of Mexico (stations 2115, 2352, 2385), 460 to 840 fathoms.

BILOCULINA COMATA Brady.

(Plate 39, fig. 3.)

Subglobular in form, otherwise like *B. ringens;* characterized specifically by surface ornamentation consisting of more or less conspicuous, fine, straight, parallel striæ covering the whole shell; aperture an arched slit, with a broad, thick valvular lower lip.

Locality.—West coast of Cuba (station 2352), 463 fathoms.

BILOCULINA ELONGATA d'Orbigny.

(Plate 39, fig. 4.)

Like *B. ringens* except that it is long oval in contour. The typical specimens are small, but there is constant variation both in size and breadth of oval.

Localities.—Gulf of Mexico and the North Atlantic (stations 2383, 2385, 2584), 500 to 1,200 fathoms.

BILOCULINA DEPRESSA d'Orbigny.

(Plate 40, fig. 1.)

Smooth, compressed, round; margin thin and sharp; aperture usually a long, narrow slit, with a valvular lower lip thinner and less prominent than in *B. ringens;* rarely the aperture is contracted to a nearly circular orifice. Longitudinal section shows the conformation and arrangement of the chambers.

Localities.—Gulf of Mexico and off Marthas Vineyard (stations 2374, 2378, 2568, 2570), 26 to 1,830 fathoms.

BILOCULINA DEPRESSA, var. SERRATA Brady.

(Plate 40, fig. 2.)

Identical in general characters with *B. depressa*, but having the edge dentate, with more or less closely set teeth. The penultimate segment often shows the serrations more conspicuously than the final one.

Localities.—North Atlantic, Gulf of Mexico, and Panama Bay (stations 2530, 2383, 2399, 2805), 50 to 1,200 fathoms.

BILOCULINA DEHISCENS, new species.

(Plate 40, fig. 3.)

This species has the same general characters as *B. depressa* and its variety *serrata*, but the last two chambers are more or less separated at the sides, giving the shell the appearance of rupture from internal growth and distension. In general the separation is sufficient to show the sharp edge of the third segment on each side, but series presenting all degrees of gradation from Biloculina to Spiroloculina have been selected from material dredged at a single station.

Locality.—Gulf of Mexico (station 2377), 210 fathoms. (See *Spiroloculina robusta*, series.)

BILOCULINA LÆVIS Defrance.

(Plate 41, fig. 1.)

Less compressed than *B. depressa*, less inflated than *B. ringens*; characterized by the double border formed by the slight projection of the margin of the penultimate segment.

Locality.—Gulf of Mexico (station 2394), 420 fathoms.

BILOCULINA SPHÆRA d'Orbigny.

(Plate 41, fig. 2.)

Specific characters well marked. Contour nearly spherical; each chamber incloses the preceding one almost entirely, leaving exposed only a small circular segment of the penultimate chamber. Aperture an irregular, often branched or bordered, V-shaped slit. Section shows arrangement of chambers and degree of investment.

Localities.—North Atlantic, Gulf of Mexico, and coast of Brazil (stations 2352, 2385, 2415, 2754, 2760), 440 to 1,000 fathoms.

BILOCULINA IRREGULARIS d'Orbigny.

(Plate 41, fig. 3.)

Differs from other species of this genus in that it is compressed at the sides instead of from above downward. Seen from above the contour is oval; from the side the outline is broader, approaching the circular when the compression is considerable. Aperture circular or broad, with a valvular lip in the somewhat protuberant oral end.

Localities.—Caribbean Sea and Gulf of Mexico (stations 2754, 2144, 2352, 2355, 2383, 2385, 2394), 400 to 1,200 fathoms.

Genus SPIROLOCULINA.

Chambers arranged in a single plane, the whole of them visible on both sides of the shell.

SPIROLOCULINA ROBUSTA Brady.

(Plate 42, fig. 1.)

Much compressed laterally, broad-oval to nearly round, more or less concave on both sides; extremities angular or pointed; periphery rounded, with sharp, projecting marginal angles, which are often toothed. Four to six segments visible on both sides, outlined by the acute prominent marginal angles; aperture round, with a T-shaped valvular tooth in the protruding end of the final segment. Longitudinal and transverse sections show the arrangement of chambers characteristic of the genus.

Locality.—Gulf of Mexico (stations 2383, 2399), 200 to 1,200 fathoms.

SPIROLOCULINA ROBUSTA, series.

(Plate 42, fig. 2.)

This is a series, selected from material dredged at a single station, to show an apparent evolution of *Spiroloculina robusta* from *Biloculina depressa*. The specimens are shown in pairs, the first of the pair being a whole shell resting upon its side, the other being a transverse section of a similar shell standing on end. The few specimens exhibited show a passage from one form to the other by well-defined steps, but with a large number of specimens the gradation is so easy that it becomes indefinable. The series illustrates the difficulties of classification in this order of animals.

Locality.—Gulf of Mexico (station 2377), 210 fathoms.

SPIROLOCULINA EXCAVATA d'Orbigny.

(Plate 41, fig. 5.)

Small, much compressed, long oval with projecting ends, very concave, showing the minute early segments; margins broad and rounded.

Locality.—Not recorded.

SPIROLOCULINA NITIDA d'Orbigny.

(Plate 41, fig. 4.)

More or less broadly oval, flat, thin, small: the segments inflated, without angles, the final one projecting at the oral end. Long diameter, about 0.75 mm. ($\frac{1}{32}$ inch).

Locality.—Collected in the Gulf of Tokyo.

SPIROLOCULINA LIMBATA d'Orbigny.

(Plate 42, fig. 3.)

Thin, flat, broad oval, with slightly projecting ends and square margin; segments numerous; sutures marked by prominent, smooth ridges. Length, about 0.75 mm. ($\frac{1}{32}$ inch).

Localities.—Atlantic Coast of the Southern United States, and the Gulf of Mexico (stations 2312, 2313, 2358, 2420, 2614, 2641, 2400), 60 to 220 fathoms.

SPIROLOCULINA PLANULATA Lamarck.

(Plate 42, fig. 4.)

Compressed, broad oval to nearly circular; border rectangular or slightly rounded; segments not inflated, sutures rather indistinct; texture comparatively coarse. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch).

SPIROLOCULINA ARENARIA Brady.

(Plate 43, fig. 1.)

Oval, much compressed, peripheral edge rounded, surface sandy and rough; sutural lines wholly obscured; aperture small, round, with a minute T-shaped tongue. Length, 0.75 mm. ($\frac{1}{32}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

Genus MILIOLINA.

Chambers inequilateral, coiled around the long axis of the shell in such a way that more than two (usually three or five) are visible externally.

MILIOLINA SEMINULUM Linnæus.

(Plate 43, fig. 2.)

Contour as seen from above oval, from the end or side triangular, with rounded angles; surface smooth, with the clear white luster of porcelain characteristic of the Miliolidæ. Segments somewhat inflated, usually four of them partially visible on one side and three on the other; aperture round or oval, with a conspicuous appendicular tooth. Length, about 1.25 mm. ($\frac{1}{20}$ inch). The species is common in every latitude and at all depths.

Localities.—Specimens collected in the Gulf of Mexico, North Atlantic, and off coast of Brazil (stations 2570, 2568, 2751, 2383, 2392, 2760), 725 to 1,800 fathoms.

MILIOLINA GRACILIS d'Orbigny.

(Plate 43, fig. 5.)

Very small, long oval; segments nearly cylindrical, three of them visible on one face, and two on the other; aperture large with slightly protuberant lips. Length, about 0.5 mm. ($\frac{1}{50}$ inch).

Localities.—Cozumel Island, and off Carysfort Light, Florida (stations 2358, 2641), 222 and 60 fathoms.

MILIOLINA OBLONGA Montagu.

(Plate 43, fig. 3.)

Small, long oval in contour; otherwise like *M. seminulum*. Length, about 0.4 mm. ($\frac{1}{60}$ inch).

Localities.—From vicinity of the island of Trinidad and off coast of Brazil (stations 2754, 2760), 880 to 1,000 fathoms.

MILIOLINA AUBERIANA d'Orbigny.

(Plate 43, fig. 6.)

Larger than *M. seminulum*, and with the margins of the segments more sharply angular. Section shows the triangular contour of the shell and the characteristic milioline arrangement of the chambers.

Localities.—Atlantic coast of the United States, off the island of Trinidad, and off the coast of Brazil (stations 3150, 2570, 2584, 2754, 2760), 400 to 1,800 fathoms.

MILIOLINA CUVIERANA d'Orbigny.

(Plate 43, fig. 4.)

A rather large, smooth-shelled variety, characterized by the acutely angular margins of the five visible segments.

Localities.—Coast of Brazil (station 2762) and the Gulf of Tokyo, 59 and 9 fathoms.

MILIOLINA VENUSTA Karrer.

(Plate 44, fig. 2.)

Oval, angular, the margins of the three final segments extended so as to form well-marked keels; oval extremity of the last segment generally protuberant. Length, about 0.625 mm. ($\frac{1}{40}$ inch).

Localities.—West coast of Patagonia (station 2784) and Gulf of Tokyo, 194 and 9 fathoms.

MILIOLINA CIRCULARIS Bornemann.

(Plate 44, fig. 1.)

Smooth, slightly compressed, nearly circular in broadest outline; chambers inflated; aperture a crescentic slit with arched upper and thin projecting lower lip. Length, about 0.75 mm. ($\frac{1}{32}$ inch).

Localities.—Off Cape Hatteras, west coast of Cuba, and Trinidad (stations 2115, 2353, 2754), 167 to 880 fathoms.

MILIOLINA TRIGONULA Lamarck.

(Plate 44, fig. 3.)

Oblong, broad, oval in end view, exposing two chambers on one side and three, rarely four, on the other; oral end of the final segment often tubular; aperture round, with T-shaped valvular tooth. Transverse section of a broad specimen shows arrangement of the chambers.

Localities.—Atlantic coast of the United States and the Gulf of Mexico (stations 2228, 2570, 2385), 700 to 1,800 fathoms.

MILIOLINA TRICARINATA d'Orbigny.

(Plate 44, fig. 4.)

Distinctly triangular in end view, the three angles thickened and slightly produced or keeled. Two of the angles are formed by the last

segment, the third by the free margin of the preceding segment. Aperture triangular, toothed. Length, about 0.625 mm. ($\frac{1}{40}$ inch).

Locality.—Off Windward Islands (station 2751), 687 fathoms.

MILIOLINA SUBROTUNDA Montagu.

(Plate 44, fig. 6.)

A small, thick, rounded, suborbicular shell, with three visible segments; surface slightly wrinkled transversely; terminal segment not projecting at the oral extremity; orifice large, with a prominent valvular tooth. Diameter, about 0.4 mm. ($\frac{1}{60}$ inch).

Locality.—Straits of Yucatan, 222 fathoms.

MILIOLINA VALVULARIS Reuss.

(Plate 44, fig. 5.)

A rather large, stout shell, having the same form and arrangement of segments as *M. circularis.* The distinguishing feature of this species is the aperture, which is a very narrow, irregularly bent, sometimes branching slit, with puckered lips.

Locality.—Cape Hatteras (station 2115), 843 fathoms.

MILIOLINA BUCCULENTA Brady.

(Plate 45, fig. 1.)

Large, subglobular, slightly and symmetrically compressed at the sides; especially characterized by the position of the three final and only visible segments in very nearly the same plane; aperture a long, arched slit across the face of the last segment.

Locality.—North Atlantic.

MILIOLINA LABIOSA d'Orbigny.

(Plate 45, fig. 3.)

Small, thin-shelled; segments few, inflated, often somewhat distorted, irregularly arranged; aperture large, crescent-shaped.

Locality.—Straits of Yucatan (station 2358), 222 fathoms

MILIOLINA INSIGNIS Brady.

(Plate 45, fig. 2.)

Has the form of *M. trigonula*, or more often of *M. circularis.* The peculiarity of the shell is the surface ornamentation with fine, more or less prominent, parallel ribs.

Localities.—West coast of Cuba and the Caribbean Sea (stations 2352, 2150), 463 and 382 fathoms.

MILIOLINA UNDOSA Karrer.

(Plate 45, fig. 4.)

In this species of Miliolina the exposed portions of the segments are angular instead of being rounded or having a single sharp margin. Moreover, the angles of the segments are wavy, giving a crumpled appearance to the shell.

Locality.—Straits of Yucatan (station 2358), 222 fathoms.

MILIOLINA ANGULARIS, new species.

(Plate 46, fig. 1.)

An angular variety of Miliolina resembling *M. undosa*, except that the visible angles of the segments are very nearly right angles, slightly ribbed at the edges, and not sinuate.

Locality.—Straits of Yucatan (station 2358), 222 fathoms.

MILIOLINA BICORNIS Walker and Jacob.

(Plate 46, fig. 2.)

Oval, compressed, the final segment projecting posteriorly well beyond the preceding segment, and generally produced into a tubular neck anteriorly. The whole surface is striate, with rather fine, parallel, raised lines. Aperture round and toothed.

Localities.—Straits of Yucatan and coast of Florida (stations 2358, 2641), 60 to 222 fathoms.

MILIOLINA LINNÆANA d'Orbigny.

(Plate 46, fig. 3.)

Contour oval, compressed, much the same as *M. bicornis;* the surface marked with a few thick, irregular costæ in place of the striæ characteristic of the latter species.

Localities.—Straits of Yucatan, the Gulf of Mexico, coast of Florida (stations 2358, 2315, 2370, 2641, 2629), 13 to 222 fathoms.

MILIOLINA SEPARANS Brady.

(Plate 46, fig. 6.)

A single specimen of this species has been found. It has much the appearance of two small *Miliolina linnæana* grown together at the side, but the smaller portion has no neck or external operture, and the form is undoubtedly due to the irregular growth of the later segments. Length, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Gulf of Mexico, off the west coast of Cuba (station 2352), 463 fathoms.

MILIOLINA PULCHELLA d'Orbigny.

(Plate 46, fig. 4.)

Apparently a modified form of *M. linnæana*, in which the longitudinal costæ are somewhat less prominent, and are supplemented by quite numerous short diagonal ridges. Length, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

MILIOLINA RETICULATA d'Orbigny.

(Plate 46, fig. 5.)

The single feature which characterizes this species is the surface ornamentation formed by two sets of fine, parallel striæ running diagonally to each other, producing a network of ridges.

Locality.—Straits of Yucatan (station 2358), 222 fathoms.

MILIOLINA AGGLUTINANS d'Orbigny.

(Plate 47, fig. 2.)

Broad, oval, thick, rounded; sutures obscure; terminal segment not produced; aperture large, with conspicuous appendicular tooth. Differs from *M. seminulum* in that the whole surface is incrusted with fine white sand. Length, from 1.5 to 0.6 mm. ($\frac{1}{16}$ to $\frac{1}{40}$ inch).

Locality.—Straits of Yucatan (station 2358), 222 fathoms.

Subfamily HAUERININÆ.

Test dimorphous; chambers partly milioline, partly spiral or rectilinear.

Genus ARTICULINA.

Chambers milioline at the commencement, subsequently in a straight series.

ARTICULINA SAGRA d'Orbigny.

(Plate 47, fig. 1.)

Irregularly long oval, or linear, compressed; the earlier segments milioline or confused, the later rectilinear; sutures constricted, each segment of the linear series overhanging the preceding; surface ornamented with fine, parallel, longitudinal striæ; aperture a long oval slit, with strongly everted lips, occupying the whole breadth of the oral extremity of the shell.

Localities.—Straits of Yucatan and the mouth of Exuma Sound (stations 2358, 2629), 222 to 1,169 fathoms.

Genus VERTEBRALINA.

Early chambers partly milioline and partly planospiral; later segments in straight series.

VERTEBRALINA INSIGNIS Brady.

(Plate 47, fig. 4.)

Much compressed, nearly symmetrical bilaterally, margin angular, often keeled. Early segments may be planospiral (in one specimen this arrangement of the minute early chambers is quite evident), or milioline, or both; latest segments united at such an angle that the last three include all the others; no chambers of the straight series appear in the specimens shown. Surface rather coarsely striate; aperture a long oval mouth with everted lips.

Localities.—Gulf of Mexico, coast of Florida, and off Chesapeake Bay (stations 2400, 2420, 2641), 60 to 169 fathoms.

Genus OPHTHALMIDIUM.

Cornuspira-like at the commencement, subsequently with two or more segments in each convolution.

OPHTHALMIDIUM INCONSTANS Brady.

(Plate 47, fig. 3.)

A thin, flat shell; begins with a small central globular chamber; continues as a fine, coiled, non-septate tube, and ends by the tube becoming larger and divided into chambers by constriction at opposite points in each convolution. Segments with broad keels which separate the convolutions.

Localities.—Gulf of Mexico, Bahama Islands, coast of North Carolina (stations 2392, 2629, 2614), 168 to 1,169 fathoms.

Genus PLANISPIRINA.

Chambers milioline at the commencement, subsequently planospiral; the lateral alar prolongations of the latest convolution inclosing the previous whorls.

PLANISPIRINA SIGMOIDEA Brady.

(Plate 47, fig. 6.)

Compressed, nearly circular, projecting slightly at the ends, the two faces unequally convex, and the margin thin but rounded; segments two to each convolution, and set on at the margin of alternate sides, producing a milioline arrangement of the chambers; surface smooth and shining; aperture a gaping, transverse orifice in the oral prominence. Diameter, about 0.75 mm. ($\frac{1}{32}$ inch). Transverse section shows arrangement of the chambers, and, indistinctly, the successive layers of which the sides of the shell are composed.

Localities.—West India Islands, Bahamas, Trinidad, and coast of Brazil (stations 2117, 2629, 2754, 2760), 680 to 1,170 fathoms.

PLANISPIRINA CELATA Costa.

(Plate 47, fig. 5.)

Contour long oval with projecting ends, somewhat compressed, the two sides unequally convex, the margins thick and rounded; surface rough, and texture sandy; aperture small and arched. Length, about 1.25 mm. ($\frac{1}{20}$ inch). Transverse section shows the arrangement of chambers to be the same as in the last described species.

Localities.—The vicinity of Aspinwall, west coast of Cuba, coast of Brazil, and coast of Oregon (stations 2144, 2352, 2760, 3080), 100 to 1,000 fathoms.

Subfamily PENEROPLIDINÆ.

Test planospiral or cyclical, sometimes crozier-shaped, bilaterally symmetrical.

Genus CORNUSPIRA.

CORNUSPIRA FOLIACEA Philippi.

(Plate 48, fig. 1.)

A very thin, flat shell, consisting of a tube without partitions or constrictions, minutely narrow at first, but gradually and rather rapidly becoming larger and more compressed, the tube evenly coiled upon itself in a perfectly flat spiral; surface wrinkled transversely; aperture a long narrow slit formed by the abrupt termination of the flattened tube.

Localities.—Gulf of Mexico, and off Marthas Vineyard (stations 2352, 2377, 2383, 2550), 210 to 1,180 fathoms.

CORNUSPIRA INVOLVENS Reuss.

(Plate 48, fig. 3.)

A simple coiled tube, minute in the earlier convolutions, growing larger and stouter in the later turns without becoming flattened as in *C. foliacea* just described. Diameter, 0.625 to 1.5 mm. ($\frac{1}{40}$ to $\frac{1}{16}$ inch).

Localities.—Caribbean Sea, Straits of Yucatan, and coast of Georgia (stations 2150, 2352, 2416), 276 to 463 fathoms.

CORNUSPIRA CARINATA Costa, species.

(Plate 48, fig. 2.)

A simple planospiral coil, intermediate in form between *C. foliacea* and *C. involvens*. The tube increases gradually in size and its outer margin is marked by a narrow keel. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch.)

Locality.—Gulf of Mexico (station 2394), 420 fathoms.

Genus PENEROPLIS.

Chambers undivided; arrangement either planospiral throughout or spiral only at the commencement, subsequently becoming rectilinear or cyclical.

PENEROPLIS PERTUSUS Forskal.

(Plate 48, fig. 4.)

This species includes a wide variety of forms presenting all the intermediate stages from thick, slightly compressed, nautiloid shells, to the long, cylindrical, crosier-shaped varieties, and from these to the thin, compressed, rapidly widening forms. In all varieties the chambers are without divisions or constrictions, the apertures are porous, and the surface, with few exceptions, is striate.

Localities.—Straits of Yucatan and Exuma Sounds (stations 2352, 2629), 463 and 1,169 fathoms.

PENEROPLIS PERTUSUS, variety DISCOIDEUS, new.

(Plate 49, fig. 1.)

In this variety the final chambers completely surround the primary convolutions, forming a circular, thin disk resembling the discoidal forms of Orbulina, but distinguished by the entire absence of septa in the individual chambers.

Locality.—Key West Harbor; shallow water.

Genus ORBICULINA.

Chambers subdivided by transverse secondary septa; early segments embracing; arrangement either planospiral throughout or partly cyclical; contour nautiloid, auricular, crosier-shaped, or complanate.

ORBICULINA ADUNCA Fichtel and Moll.

(Plate 50, fig. 1.)

The only species of the genus. A planospiral, porcellanous, imperforate, polished shell, varying in contour from crosier-shaped to discoidal; surface usually pitted with minute depressions; the early convolutions embracing; chambers narrow and regularly subdivided; apertures a series of pores in two or more rows on the outer edge of the final chamber. It is distinguished from Peneroplis by the divided chambers, and from Orbitolites by the embracing early convolutions.

Localities.—Key West and St. Thomas; shallow water.

Genus ORBITOLITES.

Test discoidal; either spiral (non-embracing) at the commencement, or with one or more inflated primordial chambers; subsequently cyclical; chambers more or less regularly divided into chamberlets.

ORBITOLITES MARGINALIS Lamarck.

(Plates 50, fig. 2; 51, fig. 1.)

A very thin, complanate, discoidal shell; chambers commencing at the center with a small globular "nucleus," followed by arched segments arranged spirally in one plane, the segments increasing in

length until they become concentric rings; segments divided by radial partitions into numerous chamberlets with free communication; a single row of pores on the margin of the disk forms the only exterior aperture.

Localities.—Key West, Florida, and off Cape Fear (station 2623).

ORBITOLITES DUPLEX Carpenter.

(Plate 51, figs. 2, 3.)

Shell thin, discoidal, slightly biconcave; primordial chamber conspicuous, globular; second chamber nearly surrounds the first; succeeding segments rapidly lengthen and quickly become annular. Chambers divided by septa into chamberlets, arranged in a double tier, with free communication. Peripheral orifices in two rows, corresponding to the double tier of chamberlets. This latter feature together with the early annular segments, distinguish this species from others of the genus. Diameter, 1 to 2.5 mm. ($\frac{1}{25}$ to $\frac{1}{10}$-inch).

Locality.—Key West, Florida.

ORBITOLITES TENUISSIMA Carpenter.

(Plate 52.)

An extremely thin and delicate shell, having the form of a circular disk with flat surfaces. In the arrangement of the chambers it commences as a convoluted, planospiral, nonseptate tube; it continues with a short series of spiral chambers and ends with a broad series of annular chambers. The spiral and annular chambers are partially divided, by partitions projecting from the inner walls, into numerous chamberlets. The chamberlets of each annulus communicate not only with each other but also with those of the succeeding annulus. A single row of pores opens on the margin of the final chamber. Diameter, from 1 to 20 mm. ($\frac{1}{25}$ to $\frac{4}{5}$ inch). The shaded portions in the figure are those parts of the specimen still occupied by the protoplasmic substance of the animal.

Locality.—Atlantic, south of Marthas Vineyard (station 2716), 1631 fathoms.

Family VI. LAGENIDÆ.

Test calcareous, very finely perforated; ether monothalamous, or consisting of a number of chambers joined in a straight, curved, spiral, alternating or (rarely) branching series. Aperture simple or radiate, terminal. No interseptal skeleton nor canal system.

Subfamily LAGENINÆ.

Test consists of a single chamber, either with or without an internal tube.

Genus LAGENA.

Test monothalamous, with either an external or internal tubular neck.

LAGENA GLOBOSA Montagu.

(Plate 53, fig. 4.)

Spherical, with a short conical protuberance ornamented with longitudinal costæ, body smooth, walls transparent, finely perforated, aperture leading into a short internal neck (entosolenian). This description applies to a single specimen from the Caribbean Sea near Aspinwall (station 2144), 896 fathoms.

LAGENA LONGISPINA Brady.

(Plate 53, fig. 2.)

Subglobular or pear-shaped; surface smooth; walls thin, glassy, more or less transparent, finely perforated, furnished with several (two to six or more) long, slender spines springing from the base of the shell; aperture round, central, at the apex, opening into a long neck or tube extending into the interior of the shell and terminating in a broadly expanded margin. Length of body, about 0.6 mm. ($\frac{1}{40}$ inch).

Localities.—Near Aspinwall, Gulf of Mexico, off Trinidad (stations 2144, 2394, 2754), 420 to 898 fathoms.

LAGENA GRACILLIMA Seguenza.

(Plate 53, fig. 3.)

A very delicate shell, with thin, transparent, and fragile walls and smooth surface; body either cylindrical or fusiform, drawn out at each end into a long thin neck; apertures simple, terminating the tubular neck at both ends of the shell, often surrounded at one end by an everted lip like the mouth of a phial.

Localities.—Various stations along the Atlantic and Gulf coast of the United States, at depths from 210 to 1,781 fathoms.

LAGENA ELONGATA Ehrenberg.

(Plate 53, fig. 1.)

Like *L. gracillima*, except that the body is long and cylindrical, with a short taper at both ends. Length, about 2 mm. ($\frac{1}{12}$ inch).

LAGENA DISTOMA Parker and Jones.

(Plate 53, fig. 5.)

Like *L. Gracillima* in its variety of forms, but characterized by more or less numerous, delicate, longitudinal striæ marking its surface.

LAGENA LÆVIS Montagu.

(Plate 53, fig. 6.)

Minute, flask-shaped, straight or curved, with an oval, pyriform or globular chamber and a more or less prolonged tubular neck; walls generally very thin, smooth, and transparent, but sometimes the shell

is opaque and with a roughened surface; aperture simple, at the end of the tubular neck. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Not recorded.

LAGENA HISPIDA Reuss.

(Plate 53, fig. 8.)

Body globular or oval, with a long tubular neck projecting from one or both ends, the whole surface covered with fine, short, closely set spines. Length of body, about 0.4 mm. ($\frac{1}{64}$ inch).

Localities.—Gulf of Mexico, and off Windward Islands (stations 2398, 2751), 227 and 687 fathoms.

LAGENA SULCATA Walker and Jacob.

(Plate 53, fig. 7.)

Minute, flask-shaped; the neck long and slender, or short and stout, variously ornamented; the body decorated with numerous parallel, rather thin and sharp ridges or costæ. Length, about 0.4 mm ($\frac{1}{60}$ inch).

Localities.—Off Atlantic coast of the southern United States (stations 2420, 2614, 2641), 60 to 168 fathoms.

LAGENA STAPHYLLEARIA Schwager.

(Plate 54, fig. 1.)

Compressed pyriform, smooth, the apical margin rounded, the basal margin thin, broad and extended into four or five short stout spines; external aperture leading into an internal tube (entosolenian). Length, about 0.4 mm ($\frac{1}{60}$ inch).

Locality.—Caribbean Sea, near Aspinwall (station 2144), 896 fathoms.

LAGENA MARGINATA Walker and Boys.

(Plate 54, fig. 2.)

Contour round, lenticular, margin thin, sharp, and prolonged into a more or less broad wing projecting from the entire circumference; surface smooth; walls thin, generally transparent, and finely perforated; aperture a short horizontal slit at the margin, communicating with a tubular neck extending into the cavity of the shell. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—Caribbean Sea, Gulf of Mexico, and South Atlantic (stations 2144, 2150, 2385, 2394, 2395, 2754), 347 to 896 fathoms.

LAGENA CASTANEA, new species.

(Plate 54, fig. 3.)

Contour nearly circular, compressed, slightly protuberant at the oral end; margin rounded and smooth except at the aboral end, which is bicarinate; keels or wings thin, comparatively wide and well separated,

extending about half the circumference of the test, joining each other at the extremities; mouth short, oval, with a contorted internal tubular neck. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—Near Aspinwall (station 2144), 896 fathoms.

LAGENA ORBIGNYANA Seguenza.

(Plate 54, fig. 4.)

Oval, compressed, the oral end protuberant and tapering; body smooth, the circumference bordered by three parallel wings or keels, the middle one widest. The aperture is at the end of a prolongation of the middle keel only. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Localities.—Caribbean Sea, Gulf of Mexico (stations 2117, 2144, 2355, 2394), 399 to 896 fathoms.

LAGENA CASTRENSIS Schwager.

(Plate 54, fig. 5.)

Form and general characters the same as *L. orbignyana;* distinguished by a surface ornamentation of regular rows of thickly set circular pits covering more or less completely the body and wings of the shell.

The published descriptions of *L. castrensis* call for a surface ornamentation of "exogenous beads," but in the specimens here described the surface is unquestionably pitted. The test is tricarinate and has all the other general characters of *L. castrensis.*

Locality.—Off Nantucket Shoals (station 2252), 38 fathoms.

Subfamily NODOSARINÆ.

Test polythalamous; straight, arcuate, or planospiral.

Genus NODOSARIA.

Test straight or curved, circular in transverse section; aperture typically central.

NODOSARIA ROTUNDATA Reuss.

(Plate 54, fig. 6.)

Oval or ovate, smooth, consisting of a few overlapp ng segments; sutures not depressed, indistinct; walls thin and white; aperture composed of a large number of radiating fissures, central at the end of the slightly produced terminal segment. Length, about 1 mm. ($\frac{1}{25}$ inch).

Localities recorded.—Five stations in the North Atlantic (stations 2212, 2550, 2571, 2577, 2586), 32 to 1,356 fathoms.

NODOSARIA LÆVIGATA d'Orbigny.

(Plate 55, fig. 3.)

Oval, tapering at both ends, circular in section; surface smooth and polished; sutures indistinct; distinguished from *N. rotundata* principally

by the spines (one or several) projecting from the inferior end of the shell.

Localities.—Gulf of Mexico and west coast of Patagonia (stations 2352, 2377, 2395, 2784), 194 to 463 fathoms.

NODOSARIA RADICULA Linnæus.

(Plate 55, fig. 1.)

Oval, elongated, smooth, composed of two or more segments in a straight series; sutures depressed; aperture central, consisting of radiating fissures in the protuberant end of the last segment. Length, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—South of Long Island, southeast of Georges Bank (stations 2234, 2570), 810 to 1,813 fathoms.

In typical specimens the segments are more inflated and the sutures more depressed than those figured in the accompanying plate.

NODOSARIA SIMPLEX Silvestri.

(Plate 55, fig. 2.)

Consists of two inflated, subglobular segments, the first terminating in a short spine, the second slightly elongated and tapering to the radiate aperture; sutures a little depressed; walls thin and transparent, finely perforated. Length, about 0.8 mm. ($\frac{1}{32}$ inch).

Locality.—Off Cape Hatteras (station 2115), 843 fathoms.

NODOSARIA PYRULA d'Orbigny.

(Plate 55, fig. 4.)

A long, slender, delicate shell, composed of a series of oval or ovate segments of nearly uniform size, joined together in a straight or slightly curved line by means of long tubular necks; surface smooth, without ornamentation. Length, indefinite. Owing to the fragility of the shell a whole one is rarely found. One specimen in the collection is over 8 mm. ($\frac{5}{16}$ inch) long.

Locality.—Gulf of Mexico (stations 2377, 2378, 2399), 68 to 210 fathoms.

NODOSARIA FARCIMEN Soldani.

(Plate 55, fig. 5.)

An elongated, tapering, slightly curved shell, composed of from four to eight oval or inflated segments, rapidly increasing in size from the first; segments separated by deep depressions, sometimes lengthened into a short neck; surface generally smooth, occasionally roughened about the sutures. Length, about 2.5 mm. ($\frac{1}{10}$ inch).

Localities.—Caribbean Sea, Gulf of Mexico, east coast of Florida (stations 2150, 2352, 2377, 2679), 210 to 782 fathoms.

NODOSARIA FILIFORMIS d'Orbigny.

(Plate 55, fig. 6.)

Long, slender, slightly curved, composed of numerous oval, smooth segments joined in linear series; sutures moderately depressed and transverse. Length, 3 to 4.5 mm. ($\frac{1}{8}$ to $\frac{3}{16}$ inch).

Locality.—Gulf of Mexico (stations 2377, 2378, 2399, 2400), 68 to 210 fathoms.

NODOSARIA CONSOBRINA, variety EMACIATA Reuss.

(Plate 56, fig. 1.)

Long, slender, slightly curved and tapering, composed of numerous short, nearly cylindrical segments, arranged in linear series; sutures not depressed except near the oral end; surface smooth. Length, 3 to 8 mm. ($\frac{1}{8}$ to $\frac{1}{3}$ inch).

Locality.—Gulf of Mexico (stations 2378, 2399), 68 and 196 fathoms.

NODOSARIA SOLUTA Reuss.

(Plate 56, fig. 3.)

A rather stout shell, composed of globular or short-oval segments, comparatively few in number, arranged in a straight or slightly curved line; initial segment large and spherical; surface smooth, or sometimes bristly rough about the sutures; aperture a round opening with short radiating fissures in the center of the protruding end of the terminal segment.

Localities.—Gulf of Mexico, North Atlantic, South Atlantic, Panama Bay (stations 2385, 2394, 2550, 2679, 2760, 2784, 2805), 51 to 1,081 fathoms.

NODOSARIA COMMUNIS d'Orbigny.

(Plate 56, fig. 2.)

Slender, tapering, curved; segments numerous, smooth; sutural lines oblique, obvious, little if at all depressed. Length, 2 to 3 mm. ($\frac{1}{12}$ to $\frac{1}{8}$ inch).

Localities.—Off Nantucket Shoals, Gulf of Mexico, off Cape Fear, west coast of Patagonia (stations 2041, 2377, 2679, 2784), 194 to 1,608 fathoms.

NODOSARIA RŒMERI Neugeboren.

(Plate 56, fig. 5.)

Elongate, cylindrical, or slightly tapering, rounded at the base; segments few; walls thin and transparent; sutures full and more or less oblique, especially the earlier ones; aperture terminal, radiate. Length, 1 to 4.5 mm. ($\frac{1}{25}$ to $\frac{3}{16}$ inch).

Localities.—Off Nantucket Shoals and at the mouth of Exuma Sound (stations 2041, 2629), 1,608 and 1,169 fathoms.

NODOSARIA HISPIDA d'Orbigny.

(Plate 57, fig. 1.)

Composed of a linear series of globular segments, each with or without a more or less prolonged tubular neck, arranged usually in a straight line, the whole surface thickly beset with short, mostly tubular spines. Length, about 2.5 mm. ($\frac{1}{10}$ inch).

Locality.—Gulf of Mexico (station 2398), 227 fathoms.

NODOSARIA HISPIDA, variety SUBLINEATA Brady.

(Plate 56, fig. 4.)

Varies from *N. hispida* in that delicate raised lines take the place of spines over a portion of the surface of one or more of the segments.

Locality.—Gulf of Mexico (station 2378), 68 fathoms.

NODOSARIA MUCRONATA Neugeboren.

(Plate 57, fig. 2.)

Elongate, conical, more or less curved, tapering to a point at the aboral end, the final segment also frequently prolonged and conical; sutures oblique and full; surface smooth and even; aperture radiate. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—South of Marthas Vineyard and Gulf of Mexico (stations 2550, 2568, 2383), 390, 1,181, and 1,781 fathoms.

NODOSARIA COMATA Batsch.

(Plate 57, fig. 3.)

Ovate or long-oval, tapering and rounded at both ends, composed of a few segments arranged in a straight series; sutures slightly depressed; surface ornamented with numerous longitudinal ridges extending from the extreme point of the initial segment to about the middle of the final one. Length, about 0.75 mm. ($\frac{1}{32}$ inch).

Localities.—Gulf of Mexico, coast of Georgia, off Cape Romain (stations 2352, 2377, 2416, 2627), 210 to 463 fathoms.

NODOSARIA OBLIQUA Linnæus.

(Plate 57, fig. 4.)

Long, slightly curved, tapering, slender, the initial end generally terminating in a spine; segments numerous, the later ones somewhat inflated; sutures more or less depressed; surface ornamented with numerous longitudinal, continuous ridges. Section shows the chambers, cavities, and the communicating passages.

Localities.—Off Atlantic coast of the United States, and the Gulf of Mexico (stations 2264, 2313, 2394, 2530, 2550), 99 to 1,081 fathoms.

NODOSARIA VERTEBRALIS Batsch.

(Plate 57, fig. 5.)

Long, slender, tapering, costate, differing from *N. obliqua* chiefly in that the sutures are not depressed, and the septa are thick and of transparent shell-substance, which contrasts with the white opacity of the body of the segments. Length, about 5 mm. ($\frac{1}{5}$ inch).

Locality.—Gulf of Mexico (stations 2377, 2378, 2399, 2400), 68 to 198 fathoms.

NODOSARIA CATENULATA Brady.

(Plate 58, fig. 2.)

Long, slender, straight or slightly curved, tapering, the initial segment terminating in a short spine; segments numerous; sutures depressed; surface ornament of four equidistant longitudinal ribs, sometimes continuous, sometimes only bridging the sutures and disappearing on the body of the segment. Differs from *N. vertebralis* in its depressed sutures and the limited number of ribs. Length, about 4.5 mm. ($\frac{3}{16}$ inch).

Locality.—Gulf of Mexico (station 2400), 169 fathoms.

NODOSARIA COSTULATA Reuss.

(Plate 58, fig. 1.)

In size and outline the same as *N. pyrula*, but with thicker walls and having the surface ornamented with longitudinal ridges extending sometimes continuously over the whole length of the segments, at other times over only a part of its length.

Locality.—Gulf of Mexico (stations 2377, 2398), 210 and 227 fathoms.

Genus LINGULINA.

Test straight, compressed; aperture typically a narrow fissure.

LINGULINA CARINATA d'Orbigny.

(Plate 58, fig. 3.)

Broad oval or ovate, the margin thin and slightly carinate, smooth; segments four or five, embracing; sutures slightly if at all depressed; aperture a narrow transverse fissure at the end of the final segment. Length, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Coast of Georgia (station 2416), 276 fathoms.

LINGULINA CARINATA, variety SEMINUDA Hantken.

(Plate 58, fig. 4.)

Ovate, compressed, margins rounded, composed of a few (three to six) segments, rapidly increasing in size, arranged in straight series; sutures slightly depressed; surface smooth on the compressed sides, ornamented on the margins with several delicate longitudinal ribs;

aperture a transverse slit at the end of the last segment. Section shows the form and arrangement of the chambers. Length, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Gulf of Mexico (stations 2399, 2400), 169 to 170 fathoms.

Genus FRONDICULARIA.

Test compressed or complanate, segments V-shaped, equitant; primordial chamber distinct.

FRONDICULARIA ALATA d'Orbigny.

(Plate 59, fig. 1.)

Triangular or ovate, much compressed, smooth, transparent; commencing usually with a globular chamber, which often bears a projecting spine, the succeeding segments are V-shaped, their arms becoming longer with each additional segment, so that the ends are approximately in line with the initial chamber. Sometimes the earlier segments are irregular, one arm only of the V being developed. Segments numerous; aperture terminal, round, with lateral fissures. Length, 3 mm. ($\frac{1}{8}$ inch), more or less.

Locality.—Gulf of Mexico (stations 2377, 2399), 210 and 198 fathoms.

FRONDICULARIA INÆQUALIS Costa.

(Plate 59, fig. 2.)

Oval or ovate, elongate, smooth; walls thin and fragile; early segments somewhat irregular in form and sequence; the arms of the V-shaped segments short and tapering, seldom reaching the line of the initial chamber. Length, 1.5 mm. ($\frac{1}{20}$ inch), more or less.

Locality.—North Atlantic, off coast of New York (stations 2530, 2584), 956 and 541 fathoms.

Genus MARGINULINA.

Test elongate, curved; segments nearly circular in section; aperture marginal.

MARGINULINA GLABRA d'Orbigny.

(Plate 60, fig. 1.)

Short, stout, smooth, irregularly ovate, slightly curved owing to the planospiral arrangement of the first three segments; the later segments inflated, especially on the inner side of the curve; sutures often indistinct, aperture more or less radiate. Section shows the form and arrangement of the chambers. Length, 1.5 mm. ($\frac{1}{16}$ inch), more or less.

Localities.—North Atlantic (six stations), Straits of Yucatan, Gulf of Mexico (stations 2041, 2234, 2358, 2392, 2570, 2586, 2641, 2677), 60 to 1813 fathoms.

MARGINULINA ENSIS Reuss.

(Plate 59, fig. 3.)

Elongate, subcylindrical, early segments moderately compressed, the first four or five curved so as to form about half a convolution; later segments inflated, arranged in a nearly straight line, with slightly oblique, depressed sutures; surface smooth; walls thin and rather fragile; aperture marginal, tubular, round, with radiating fissures. Length, 2.5 to 4 mm. ($\frac{1}{10}$ to $\frac{1}{6}$ inch).

Locality.—North Atlantic (stations 2242, 2343, 2614), 58 to 168 fathoms.

Genus VAGINULINA.

Test elongate, compressed or complanate; septation oblique; aperture marginal.

VAGINULINA SPINIGERA Brady.

(Plate 60, fig. 3.)

Elongate, compressed, tapering, smooth, bearing at the initial end two or more long stout spines. The earliest two or three segments are spirally arranged; subsequently they are in linear series, with more or less oblique sutural lines. Length of body, 3 mm. ($\frac{1}{8}$ inch), more or less.

Locality.—North Atlantic (stations 2263, 2586), 430 and 328 fathoms.

VAGINULINA LEGUMEN Linnæus.

(Plate 60, fig. 2.)

Elongate, slightly compressed, smooth, of nearly uniform diameter; initial end terminating in a stout marginal spine; oral extremity tapering toward the margin opposite the initial spine; sutures distinct, oblique, not depressed; no surface ornamentation. Length, about 4 mm. ($\frac{1}{6}$ inch).

Locality.—Gulf of Mexico (station 2395), 347 fathoms.

VAGINULINA LINEARIS Montagu.

(Plate 61, fig. 1.)

Elongate, slightly compressed, of nearly uniform diameter, straight or a little curved; segments numerous, the first three or four irregular, the remainder in linear series with the sutures more or less oblique; surface ornamented with many longitudinal or very slightly diagonal ribs. Length, about 2.5 mm. ($\frac{1}{10}$ inch).

Localities.—Off coast of Georgia and Florida (stations 2315, 2416, 2641), 37 to 276 fathoms.

Genus CRISTELLARIA.

Test planospiral in part or entirely; complanate, lenticular, crosier-shaped, or ensiform.

CRISTELLARIA TENUIS Bornemann.

(Plate 61, fig. 2.)

A small, elongate, slender, delicate shell, the initial portion compressed; segments numerous, the earliest ones spirally arranged, the others in linear series; walls thin and transparent; sutures near the oral end transverse and more or less depressed; aperture terminal, central. Length, 1.25 mm. ($\frac{1}{20}$ inch), more or less.

Locality.—Atlantic Coast of the United States; station doubtful.

CRISTELLARIA OBTUSATA, variety SUBALATA Brady.

(Plate 61, fig. 3.)

Elongate, slightly compressed and curved, rather broader at the initial than at the oral end; surface smooth; ventral margin rounded, dorsal margin acute and distinctly carinate at the aboral extremity; early segments spiral, later ones linear-oblique; sutures distinct but not depressed. Length, 2.5 to 4 mm. ($\frac{1}{10}$ to $\frac{1}{6}$ inch).

Localities.—Gulf of Mexico, off Cape Fear, and off Santa Lucia, West Indies (stations 2395, 2679, 2754), 347, 782, 880 fathoms.

CRISTELLARIA COMPRESSA d'Orbigny.

(Plate 62, fig. 1.)

More or less elongated, much compressed, broad at the initial end, straight or curved, the early segments plano-spiral with the outer margin more or less broadly carinate, the later segments rectilinear; sutures oblique. Length, 2.5 to 4.7 mm. ($\frac{1}{10}$ to $\frac{3}{16}$ inch).

Localities.—Off Nantucket Shoals, south of Long Island, Gulf of Mexico (stations 2041, 2234, 2385), 730 to 1,608 fathoms.

CRISTELLARIA RENIFORMIS d'Orbigny.

(Plate 62, fig. 2.)

Short, compressed, the peripheral edge sharp and sometimes carinate; segments arranged plano-spirally, except the last two or three, which are applied obliquely, forming a projecting angle, in which the aperture is situated. Length, about 2.5 mm. ($\frac{1}{10}$ inch).

Localities.—North Atlantic (four stations), Gulf of Mexico (stations 2041, 2212, 2568, 2584, 2377, 2385), 210 to 1,780 fathoms.

CRISTELLARIA SCHLOENBACHI Reuss.

(Plate 63, fig. 4.)

Small, elongate, nearly circular in section; spiral portion very short and inconspicuous, the remaining portion consisting of a few diagonal segments with slightly depressed sutures; surface smooth; walls thin and transparent. Length, 0.8 to 1 mm. ($\frac{1}{32}$ to $\frac{1}{25}$ inch). From the Gulf of Mexico (stations 2377, 2700), 210 and 169 fathoms.

CRISTELLARIA VARIABILIS Reuss.

(Plate 63, fig. 1.)

Variable in form, according to stage of development, from circular to elongate, compressed; margins generally carinate; young specimens consist of the spiral segments only; older ones have two or three oblique segments added; walls thin and transparent. Length, about 0.4 mm. ($\frac{1}{64}$ inch).

Localities.—Caribbean Sea, North Atlantic, Gulf of Mexico (stations 2144, 2263, 2584, 2378, 2394, 2398), 68 to 896 fathoms.

CRISTELLARIA CREPIDULA Fichtel and Moll.

(Plate 63, fig. 2.)

Elongate or elongate-oval, compressed, smooth, the early spiral arrangement of segments soon changing into the linear-oblique; peripheral margin rounded; sutures slightly depressed. Length, 0.8 to 3 mm. ($\frac{1}{32}$ to $\frac{1}{8}$ inch).

Localities.—Off coast of North Carolina, Georgia, Florida, and west coast of Cuba (stations 2614, 2313, 2416, 2641, 2352), 60 to 463 fathoms.

CRISTELLARIA ACUTAURICULARIS Fichtel and Moll.

(Plate 63, fig. 5.)

Small, ovoid, thick, smooth, with rounded margins; early segments small, closely spiral; later segments increasing rapidly in length and thickness, becoming oblique instead of radial, and somewhat inflated. Length, about 0.6 mm. ($\frac{1}{40}$ inch).

Localities.—Off Carysfort Light, Florida, and off the coast of South Carolina (stations 2641, 2313), 60 to 99 fathoms.

CRISTELLARIA LATIFRONS Brady.

(Plate 63, fig. 3.)

Elongate, triangular in transverse section, tapering toward each end; dorsal angle acute and carinate; ventral face broad, flat, or rounded, with acute or rounded marginal angles; early segments closely spiral, later ones growing rapidly longer and more obliquely set, the final one erect and extending nearly the whole length of the shell. Length, 1 mm. or less ($\frac{1}{25}$ inch).

Localities.—Off Carysfort Light, Florida, and Gulf of Mexico (stations 2641, 2377), 60 to 210 fathoms.

CRISTELLARIA ITALICA Defrance.

(Plate 63, fig. 6.)

Short and stout, contour in section very nearly an equilateral triangle, angles rather sharp, but not carinate; spiral segments rapidly increasing in size, more or less obliquely set; face of the final seg-

ment comparatively flat and triangular; surface smooth; aperture at the dorsal angle. Length, about 2 mm. ($\frac{1}{12}$ inch).

Localities.—Off coast of Georgia and Gulf of Mexico (stations 2415, 2399), 440 and 196 fathoms.

CRISTELLARIA GIBBA d'Orbigny.

(Plate 64, fig. 1.)

Sublenticular, equally biconvex, smooth, characterized by the somewhat inflated and protuberant final segment, and its contracted septal face. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—North Atlantic (three stations), Gulf of Mexico, coast of Yucatan (stations 2243, 2312, 2415, 2379, 2400, 2354), 63 to 1,467 fathoms.

CRISTELLARIA ARTICULATA Reuss.

(Plate 64, fig. 2.)

Test rotaliform, or sometimes with the last few segments more or less evolute; margin rounded or subcarinate; segments slightly inflated; aperture radiate, in the protuberant end of the last segment.

Localities.—Gulf of Mexico and off the coast of Georgia (stations 2399, 2400, 2416), 169 to 276 fathoms.

CRISTELLARIA ROTULATA Lamarck.

(Plate 64, fig. 4.)

Lenticular, biconvex, smooth; margin sharp, but not carinate; formed of about three convolutions, the last entirely inclosing the others; walls thick and strong. Section shows well the form and arrangement of the chambers and their apertures and the structure of the shell. Diameter, 1.5 to 2.5 mm. ($\frac{1}{16}$ to $\frac{1}{10}$ inch).

Localities.—Caribbean Sea, North Atlantic, and Gulf of Mexico (stations 2150, 2415, 2399), 196 to 440 fathoms.

CRISTELLARIA VORTEX Fichtel and Moll.

(Plate 65, fig. 1.)

Lenticular, biconvex, smooth, with a sharp noncarinate margin; distinguished by the long helicoid curve of the sutures marking the outline of the chambers. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—North Atlantic and Caribbean Sea (stations 2416, 2357), 276 and 130 fathoms.

CRISTELLARIA ORBICULARIS d'Orbigny.

(Plate 64, fig. 3.)

Form of the shell and the shape and arrangement of the chambers same as in *C. vortex.* Differs only in having the margin extended into a distinct wing or keel.

Locality.—Gulf of Mexico (stations 2377, 2400), 210 and 169 fathoms.

CRISTELLARIA CULTRATA Montfort.

(Plate 65, fig. 2.)

A lenticular, biconvex, smooth shell, in all general characters like *C. rotulata* except the peripheral margin, which in this species is extended into a thin, broad wing or keel. Diameter, 2 mm. ($\frac{1}{12}$ inch), more or less.

Locality.—Gulf of Mexico (stations 2399, 2400), 196 and 169 fathoms.

CRISTELLARIA CALCAR Linnæus.

(Plate 66, fig. 1.)

Lenticular, biconvex, smooth, carinate, in some instances with a broad keel notched and spinous at the edge, in other cases with a narrow keel and long, slender, radiating spines. Size variable; the large specimens generally have the broad keel and the small ones the long spines.

Localities.—Off the coast of the Carolinas and in the Gulf of Mexico (stations 2312, 2313, 2679, 2377, 2400), 88 to 782 fathoms.

CRISTELLARIA ECHINATA d'Orbigny.

(Plate 66, fig. 2.)

Test lenticular; margin either rounded or keeled and projected into more or less numerous radiating processes; sutures limbate and beaded. Diameter, 1.25 to 2.50 mm. ($\frac{1}{20}$ to $\frac{1}{10}$ inch).

Locality.—Gulf of Mexico (stations 2377, 2399, 2400), 169 to 210 fathoms.

CRISTELLARIA ACULEATA d'Orbigny.

(Plate 66, fig. 3.)

Elongate, moderately compressed; early segments planospiral, later ones rectilinear or curved; sutures oblique and conspicuously marked by rounded tubercles or short, stout spines; general surface, especially of the earlier segments, often tuberculated or spinous, peripheral edge sometimes finished with several long, slender spines.

Locality.—Gulf of Mexico (stations 2377, 2399), 210 and 196 fathoms.

CRISTELLARIA LIMBATA, new species.

(Plate 67, fig. 1.)

Elongate, evolute, slightly compressed, resembling *C. aculeata* in contour and arrangement of the segments; peripheral margin more or less spinous; sutures covered by thick, smooth, prominent bands of transparent shell substance, without tubercles or spines. Length, about 2 mm. ($\frac{1}{12}$ inch).

Locality.—Gulf of Mexico (stations 2377, 2399), 210 and 196 fathoms.

Subfamily POLYMORPHININÆ.

Segments arranged spirally or irregularly around the long axis; rarely biserial and alternate.

Genus POLYMORPHINA.

Segments bi- or tri- serial or irregularly spiral; aperture radiate.

POLYMORPHINA SORORIA Reuss, variety FISTULOSA.

(Plate 67, fig. 2.)

Body ovate, smooth, nearly symmetrical, composed of four or five elongated segments, arranged spirally. Upon the symmetrical body is set a final segment, irregularly globular, rough, bearing numerous slender, tubular, radiating projections with a round aperture at the end of each.

Localities.—North Atlantic, off coast of Brazil, Gulf of Mexico (stations 2221, 2568, 2763), 671 to 1,781 fathoms.

POLYMORPHINA COMPRESSA d'Orbigny.

(Plate 67, fig. 3.)

Irregularly oval, compressed, smooth, margins rounded; composed of four to eight segments arranged in two alternating series; aperture terminal, radiate; sutures more or less depressed. Length, 0.8 to 1.6 mm. ($\frac{1}{32}$ to $\frac{1}{16}$ inch).

Localities.—Off Atlantic Coast of the Southern United States (stations 2312, 2313, 2415, 2416, 2614), 88 to 440 fathoms.

POLYMORPHINA ELEGANTISIMA Parker and Jones.

(Plate 67, fig. 4.)

Ovate or pyriform, compressed unequally on two sides; margins rounded, surface smooth, segments long and arched, arranged biserially, but the alternation inequilateral; aperture terminal, radiate. Length, 1 mm. ($\frac{1}{25}$ inch) or less.

POLYMORPHINA OBLONGA d'Orbigny.

(Plate 67, fig. 5.)

Oval, elongate, more or less compressed, composed of about six oblong, inflated segments, unsymmetrically arranged and united by depressed sutures.

Localities.—Off the coast of Georgia and North Carolina (stations 2416, 2614), 276 and 168 fathoms.

POLYMORPHINA COMMUNIS d'Orbigny.

(Plate 67, fig. 6.)

Ovate, not compressed; visible segments three or four, oval, inflated, symmetrically arranged; sutures rather indistinct, not depressed. Length, 0.8 to 0.6 mm. ($\frac{1}{40}$ to $\frac{1}{30}$ inch).

Localities.—Off coast of Georgia and off Unalaska (stations 2416, 2842).

Genus UVIGERINA.

Segments arranged in a more or less regular spire around the long axis of the shell, rarely biserial. Aperture simple, usually surrounded by a phialine lip; often forming a prolonged terminal tube.

UVIGERINA TENUISTRIATA Reuss.

(Plate 68, fig. 1.)

Oval, elongate; sutures not well marked; arrangement of segments obscure; surface ornamented with numerous very fine longitudinal striæ; aperture tubular, with a phialine lip, the tube sometimes bearing two or three rings of shell substance. Length, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

UVIGERINA PYGMÆA d'Orbigny.

(Plate 68, fig. 2.)

Oval, more or less elongated, symmetrical; surface rough with thin, prominent, interrupted costæ; aperture tubular with a phialine lip. The principal feature distinguishing this species from *U. tenuistriata* is the prominence of the costæ.

Locality.—Off Cape Fear (station 2679), 782 fathoms.

UVIGERINA ANGULOSA Williamson.

(Plate 68, fig. 3.)

Small, elongate, compressed on three sides, the sides nearly equal, the angles sharp, surface roughened with more or less prominent costæ. Length, about 0.4 mm. ($\frac{1}{60}$ inch).

Localities.—Exuma Sound and Panama Bay (stations 2530, 2805), 956 and 51 fathoms.

UVIGERINA ASPERULA Czjzek.

(Plate 68, fig. 4.)

Oval or ovate, more or less elongated, rounded at the initial end, the surface roughened with short spines, sometimes set in rows and tending to run together into short costæ, at other times, especially on the terminal segment, irregularly and closely distributed; aperture phialine on a tubular neck. Length, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—Off the coast of Brazil (station 2760), 1,019 fathoms.

UVIGERINA ASPERULA, variety AMPULLACEA Brady

(Plate 68, fig. 5.)

Elongate, irregularly flask-shaped, the base being formed by the early segments arranged spirally; the later segments tending to become rectilinear and inflated, the final one being surmounted by a long tubular

neck with a phialine lip; surface, bristly-spiny. Length, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Off the Brazil coast (station 2760), 1,019 fathoms.

Subfamily RAMULININÆ.

Test irregular, branching.

Genus RAMULINA.

Test branching, composed of pyriform chambers connected by long stoloniferous tubes.

RAMULINA GLOBULIFERA Brady.

(Plate 68, fig. 6.)

Segments few, subglobular, united by long stoloniferous tubes, and each segment provided with numerous radiating tubulures; walls hyaline; surface bristly with sparsely set fine and short spines.

Locality.—Gulf of Mexico (station 2377,) 210 fathoms.

RAMULINA PROTEIFORMIS, new species.

(Plate 68, fig. 7.)

Test calcareous, extremely thin and fragile, very finely perforated; surface smooth; in form very irregular and variable, sometimes branching, sometimes with more or less numerous short digital processes, imperfectly segmented, the segments inflated into a great variety of shapes. The figures show only a few of the myriad forms assumed by this delicate foraminifer.

Locality.—Gulf of Mexico (stations 2352 and 2377), 463 and 210 fathoms.

Family VIII. GLOBIGERINIDÆ.

Test free, calcareous, perforate; chambers few, inflated, arranged spirally; aperture single or multiple, conspicuous.

Genus GLOBIGERINA.

Test coarsely perforate; trochoid, rotaliform, or symmetrically planospiral.

GLOBIGERINA BULLOIDES d'Orbigny.

(Plate 69, fig. 2.)

Subglobular, the adult shell composed of about seven nearly spherical segments, arranged spirally so that all are visible on the upper side, and three or four on the lower side; aperture of each chamber opens into a common umbilical vestibule; surface more or less rough; walls hyaline, finely and distinctly perforated. Diameter, 0.6 mm. ($\frac{1}{40}$ inch) or less.

Locality.—Coast of Yucatan (station 2358), 222 fathoms. Found in almost every part of the ocean.

GLOBIGERINA INFLATA d'Orbigny.

(Plate 69, fig. 3.)

Subglobular, flattened on the superior face; segments rather numerous, four in the final convolution; sutures depressed; aperture a large arched gaping orifice on the face of the final segment. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch). Found in almost every sea.

Localities.—North Atlantic and the Gulf of Mexico (stations 2204, 2372), 728 and 27 fathoms.

GLOBIGERINA DUBIA Egger.

(Plate 69, fig. 4.)

Subglobular, slightly compressed, segments relatively numerous, arranged spirally in about three convolutions, all the segments visible on the upper face, five or six on the lower; umbilical vestibule central, with which all the chambers directly connect; surface rough; walls finely perforated. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Panama Bay. Species widely distributed.

GLOBIGERINA RUBRA d'Orbigny.

(Plate 69, fig. 5.)

Shell composed of nearly globular segments, arranged in a spire of about three convolutions with three segments in each whorl; apertures, a single, large, arched orifice in the face of the final segment and one or two rounded openings on the superior face of several of the chambers near the sutures; surface rough; walls finely perforated; color pink. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Localities.—Widely distributed. Specimens taken off the Windward Islands and the coast of Brazil (stations 2751, 2760), 687 and 1,019 fathoms.

GLOBIGERINA CONGLOBATA Brady.

(Plate 69, fig. 6.)

Subglobular, the early segments comparatively small and compact, the last three large and inflated, the final one resting like a cap upon one side of the shell; surface rough, originally bristly-spiny, as shown by the unbroken spines in the aperture; principal aperture broad and arched at the margin of the last segment, other small orifices in the sutural depressions on the upper side of the shell; walls thick and profusely perforated. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Localities.—Widely distributed. Specimens from Windward Islands and coast of Brazil (stations 2751, 2760), 687 and 1,019 fathoms.

GLOBIGERINA SACCULIFERA Brady.

(Plate 70, fig. 1.)

Composed of seven to nine segments rather loosely aggregated spirally, the earlier ones globular, the last one or two elongated and

inflated into various and irregular forms, the peripheral extremity often bearing several short digital outgrowths; apertures multiple, large, often five visible on the superior face; walls conspicuously perforated. Diameter, 1 mm. ($\frac{1}{25}$ inch), more or less.

Localities.—Found in tropical and subtropical latitudes. Specimens from the same stations as the two preceding.

GLOBIGERINA DIGITATA Brady.

(Plate 70, fig. 2.)

Early segments spiral, regular, same as *G. bulloides;* last three segments of the final convolution elongated and rounded at the ends like the fingers of a glove, spreading radially.

Locality.—A single specimen from the Gulf of Mexico (station 2377), 210 fathoms.

GLOBIGERINA ÆQUILATERALIS Brady.

(Plate 70, fig. 3.)

Segments subglobular, increasing rather rapidly in size, arranged in a flat coil of about one convolution and half another, all the segments being equally visible on both sides; aperture a large arched opening on the inner face of each segment; walls conspicuously perforated; surface rough with the short stumps of broken spines. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Specimens dredged off the Windward Islands (station 2751), 687 fathoms.

Genus ORBULINA.

Test having the form of a single spherical chamber with two sorts of perforations, large and small.

ORBULINA UNIVERSA d'Orbigny.

(Plate 69, fig. 1.)

Typically in the form of a perfect sphere with thin walls inclosing a single chamber; occasionally two or three chambered shells are found; walls sometimes laminated, profusely perforated with both very fine and comparatively large orifices. No general aperture. Diameter, about 0.8 mm. ($\frac{1}{20}$ inch).

Localities.—The most common of all the species of foraminifera. Found in every sea.

Genus HASTIGERINA.

Test regularly nautiloid, involute; shell wall thin, finely perforated; armed with long serrate spines. Aperture a large crescentiform opening at the base of the last chamber.

HASTIGERINA PELAGICA d'Orbigny.

(Plate 70, fig. 4.)

Subglobular, compressed equally on both sides, umbilici depressed; composed of inflated segments rapidly increasing in size, arranged in a planospiral series of about two convolutions, the last convolution entirely including the others; walls thin; sutures depressed; surface roughish with the stumps of broken spines; aperture a large arched opening at the inner margin of the last segment. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Specimens exhibited are worn bottom shells collected in the Gulf of Mexico (station 2377), 210 fathoms.

Genus PULLENIA.

Test regularly or obliquely nautiloid and involute; segments only slightly ventricose; shell wall very finely perforated; aperture a long, curved slit close to the line of union of the last segment with the previous convolution.

PULLENIA QUINQUELOBA Reuss.

(Plate 70, fig. 5.)

Biconvex, bilaterally symmetrical, round, peripheral edge thick and rounded, final convolution consisting of about five segments wholly concealing the previous convolutions; surface smooth; sutures sometimes depressed, sometimes obscure; aperture a long, narrow, curved slit at the inner margin of the last segment. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Localities.—Widely distributed; specimens from the North Atlantic (three stations) and the Gulf of Mexico (stations 2115, 2204, 2584, 2352), 463 to 843 fathoms.

PULLENIA OBLIQUILOBULATA Parker and Jones.

(Plate 70, fig. 6.)

Subglobular, slightly compressed, inequilateral, obliquely nautiloid; surface smooth; walls thick and finely but conspicuously perforated; aperture a crescentic opening on the inner margin of the last segment, generally somewhat obliquely placed. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Off the Windward Islands, West Indies (station 2751), 687 fathoms.

Genus SPHÆROIDINA.

Segments few, coiled so as to form a nearly globular shell; aperture arched; sometimes partially closed with a valvular tongue.

SPHÆROIDINA BULLOIDES d'Orbigny.

(Plate 71, fig. 1.)

Nearly spherical, smooth, composed of comparatively few segments arranged in an approximately symmetrical spire; sutures slightly depressed; walls minutely and indistinctly perforated; aperture semicircular or crescentic, sometimes with a valvular lip, at the inner margin of the last segment. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—Widely distributed; specimens from North Atlantic, Gulf of Mexico, and South Atlantic (stations 2530, 2383, 2760), 956 to 1,181 fathoms.

SPHÆROIDINA DEHISCENS Parker and Jones.

(Plate 71, fig. 2.)

Subglobular; segments arranged as in *S. bulloides;* sutures at the bottom of wide and deep irregular fissures; walls thick and conspicuously perforated; aperture an arched opening into the deep fissure at the base of the last segment. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—Caribbean Sea, Gulf of Mexico, and off Windward Islands (stations 2150, 2358, 2399, 2751), 196 to 687 fathoms.

Genus CANDEINA.

Test trochoid; segments inflated; shell-walls thin, finely perforated; aperture consisting of rows of pores along the septal depressions.

CANDEINA NITIDA d'Orbigny.

(Plate 71, fig. 3.)

Contour irregular, subconical; segments twelve to fifteen, subspherical, smooth, regularly increasing in size, arranged in an elongated spiral; sutures deeply depressed, walls thin and very minutely perforated; aperture a series of pores rather closely set in the sutures uniting the segments. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—Specimens taken near the Windward Islands (station 2751), 687 fathoms.

Family IX. ROTALIDÆ.

Test calcareous, perforated; free or adherent. Typically spiral and "rotaliform;" that is to say, coiled in such a manner that all the segments are visible on the superior surface, those of the last convolution only on the inferior or apertural side, sometimes one face being more convex, sometimes the other.

Subfamily SPIRILLININÆ.

Test spiral, nonseptate.

Genus SPIRILLINA.

Test a complanate, planospiral, nonseptate tube; free or attached.

SPIRILLINA VIVIPARA Ehrenberg.

(Plate 71, fig. 4.)

A circular, double concave disk, formed by a single tube closely coiled in one plane; tube undivided, conspicuously perforated by a single row of pores; sutures thick, but not raised; aperture, the open end of the unconstricted tube. Diameter, 0.75 mm. ($\frac{1}{35}$ inch) or less.

Localities.—Not recorded.

SPIRILLINA LIMBATA Brady.

(Plate 71, fig. 5.)

Circular, concave on both sides, composed of numerous regular coils of a flattened tube; peripheral edge square; sutural line marked by a raised ridge of shell substance; general surface smooth; perforations very indistinct. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Not recorded.

SPIRILLINA OBCONICA Brady.

(Plate 71, fig. 6.)

Circular, deeply concave on one side, moderately convex on the other; peripheral edge rounded; sutures deeply depressed on the concave face, flush on the other; convolutions eight or ten; perforations on the concave face only, at the summit of minute bead-like prominences arranged in a single row along the sutural side of the tube; tube slightly constricted at regular intervals alternating with the perforations. Diameter, 0.8 to 1.2 mm. ($\frac{1}{30}$ to $\frac{1}{20}$ inch).

Locality.—Not recorded.

Subfamily ROTALINÆ.

Test spiral, rotaliform, rarely evolute, very rarely irregular or acervuline.

Genus CYMBALOPORA.

Test more or less trochoid or complanate. Segments of the trochoid forms spiral at the apex, subsequently arranged concentrically around a deep umbilical vestibule with which each chamber communicates by a neck. Complanate forms with rows of pores along the septal depressions of the inferior surface.

CYMBALOPORA POEYI d'Orbigny.

(Plate 72, fig. 1.)

Short conical, with rounded apex and flat base; composed of numerous segments, at first arranged in a regular spiral, later in circles or rings around a central vestibule, the segments of one annulus alternating more or less regularly with the one above and below; segments separated toward the center by irregular fissures; surface conspicuously

porous; aperture of each chamber opens into the central vestibule. Diameter, about 0.75 mm. ($\frac{1}{32}$ inch).

Locality.—Off the west coast of Cuba (station 2352), 463 fathoms.

Genus DISCORBINA.

Test free or adherent, rotaliform; plano-convex or trochoid; rarely complanate; aperture an arched slit, often protected by an umbilical flap, the flaps sometimes forming a whorl of subsidary chambers.

DISCORBINA GLOBULARIS d'Orbigny.

(Plate 72, fig. 2.)

Discoidal, thick, the superior face quite convex, the inferior only slightly so; segments somewhat inflated, finely perforated, hyaline, all visible superiorly, only the last convolution inferiorly; sutures a little depressed; aperture large and irregular at the umbilical margin of the last segment. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Off Carysfort Light, Florida (station 2641), 60 fathoms.

DISCORBINA ROSACEA d'Orbigny.

(Plate 72, fig. 3.)

Contour lenticular, plano-convex, peripheral margin rounded; composed of about three convolutions of six segments each; surface smooth and polished; sutures distinct but not depressed; color, pale brown; aperture a narrow arched slit at the umbilical margin of the final segment. Diameter, about 0.4 mm. ($\frac{1}{60}$ inch).

Locality.—Coast of Alaska, station unknown.

DISCORBINA BERTHELOTI d'Orbigny.

(Plate 72, fig. 4.)

Discoidal, thin, plano-convex; the superior convex face somewhat flattened at the center, peripheral margin sharp; outlines of the segments very distinct; sutures a little depressed, and thickened with transparent shell-substance; later segments moderately inflated; walls finely but distinctly perforated. Diameter, about 0.4 mm. ($\frac{1}{60}$ inch).

Localities.—North Atlantic and Gulf of Mexico (stations 2212, 2313, 2352), 79 to 463 fathoms.

DISCORBINA BICONCAVA Parker and Jones.

(Plate 72, fig. 5.)

Circular, flattened on both faces; peripheral margin square or slightly concave; coarsely perforated; sutures on the superior face between the earlier segments raised into prominent, thin, square-edged, wavy ridges; on the inferior face only slightly limbate. Diameter, about 0.4 mm. ($\frac{1}{60}$ inch).

Locality.—Gulf of Mexico (station 2400), 169 fathoms.

Genus PLANORBULINA.

Test normally adherent; compressed or complanate segments very numerous, commencing growth on a spiral plan, subsequently becoming more or less cyclical; lipped apertures of the individual segments opening externally at the periphery.

PLANORBULINA ACERVALIS Brady.

(Plate 72, fig. 7.)

Discoidal, thin, the attached side flat and smooth, the inferior face roughened by the projection of numerous irregular inflated segments over the whole surface; walls coarsely porous; apertures peripheral. Diameter, 1.5 to 2.5 mm. ($\frac{1}{16}$ to $\frac{1}{10}$ inch).

Locality.—Gulf of Mexico (station 2399), 190 fathoms.

PLANORBULINA MEDITERRANENSIS d'Orbigny.

(Plate 72, fig. 6.)

A thin, flat, nearly circular shell, when living usually attached to some foreign body, composed of numerous segments arranged in a single layer more or less distinctly spiral; attached surface nearly flat, opposite surface lobulated; periphery irregular; segments inflated, slightly embracing, very conspicuously and profusely perforated; sutures depressed; apertures at the extremity of each segment, simple, with a raised lip. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—A single specimen obtained in the Gulf of Mexico (station 2377), 210 fathoms.

Genus PULVINULINA.

Test rotaliform, superior side usually thickest; shell finely porous; segments fewer than in other rotalinæ; aperture typically a large slit at the base of the umbilical margin of the last segment.

PULVINULINA REPANDA Fichtel and Moll.

(Plate 72, fig. 8.)

Lenticular, about equally convex on both faces; peripheral margin subacute, limbate; sutures broad, conspicuous by reason of their glassy clearness, limbate on both faces; umbilicus filled smoothly with hyaline shell substance; aperture as usual.

Locality.—Arrowsmith Bank, coast of Yucatan (station 2354), 130 fathoms.

PULVINULINA PUNCTULATA d'Orbigny.

(Plate 73, fig. 1.)

Contour round or oval; superior face convex, inferior face depressed at the center; margin rounded; segments rather numerous, somewhat inflated, in about three convolutions; sutures slightly depressed; umbili-

cus narrowed by promontories of exogenous deposit. Diameter, 1 to 1.5 mm. ($\frac{1}{25}$ to $\frac{1}{16}$ inch).

Locality.—Coast of Georgia (stations 2415, 2416), 440 and 276 fathoms.

PULVINULINA AURICULA Fichtel and Moll.

(Plate 73, fig. 2.)

Long oval in contour, biconvex, the convexity of the two sides about equal, the earlier segments closely coiled, the later ones rapidly increasing in size, especially in length; walls thin, transparent, and finely perforated; sutures distinct, but not depressed or thickened; margin sharp, but not carinate. Length, 0.5 to 1 mm. ($\frac{1}{50}$ to $\frac{1}{25}$ inch).

Locality.—Gulf of Mexico (stations 2400, 2641), 169 and 60 fathoms.

PULVINULINA MENARDII d'Orbigny.

(Plate 73, fig. 3.)

Contour subcircular, much flattened, composed of about two convolutions of slightly inflated segments, all visible on the upper side, the six forming the final whorl visible on the lower side; margin thin, slightly lobed, and with a narrow keel; sutures broad, but not raised, slightly depressed on the superior side; aperture a wide slit at the inner margin of the last segment, often with a protruding under lip. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—A very common and widely distributed species. Specimens collected off Windward Islands, West Indies (station 2751), 687 fathoms.

PULVINULINA MENARDII, variety FIMBRIATA Brady.

(Plate 73, fig. 4.)

Has the same general characters as the type, but is smaller, and is distinguished by the fringed peripheral border produced by the development of numerous short spinous processes upon the normal narrow keel.

Locality.—Coast of Brazil (station 2760), 1,019 fathoms.

PULVINULINA TUMIDA Brady.

(Plate 73, fig. 5.)

Like *P. menardii*, except that the segments are more inflated, making a thicker shell, highly convex on both faces; margin not carinate; sutures slightly, if at all, depressed below.

Localities.—Off coast of Yucatan and coast of Georgia (stations 2354, 2416), 130 and 276 fathoms.

PULVINULINA CRASSA d'Orbigny.

(Plate 74, fig. 1.)

Superior face flat, showing all the convolutions; inferior face highly conical, composed of the final convolution only; umbilicus depressed; segments somewhat inflated; walls hyaline, profusely and finely per-

forated; exteriorly rough; aperture a long fissure with a raised lip at the inner margin of the final segment. Section shows chambers of the final convolution. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Not recorded.

PULVINULINA MICHELIANA d'Orbigny.

(Plate 74, fig. 2.)

Subconical, the superior face forming the base of the cone, being flat with an angular margin; the inferior face being conical, deeply excavated at the top; segments, about ten, elongated, projecting in a ridge around the umbilicus; sutures not depressed; aperture a long narrow slit at the inner margin of the last segment. Transverse section close to the superior surface has opened all but one of the ten chambers. Diameter, about 0.8 mm. ($\frac{1}{32}$ inch).

Localities.—Species widely distributed geographically. Specimens from the Gulf of Mexico (station 2377), 210 fathoms.

PULVINULINA UMBONATA Reuss.

(Plate 74, fig. 4.)

Small, biconvex, with the greatest convexity on the lower face; umbilici not depressed; margin rounded; segments rather numerous, in about three narrow convolutions; sutures straight, radial, smooth. Diameter, about 0.75 mm. ($\frac{1}{30}$ inch).

Locality.—Off coast of Oregon (station 3080).

PULVINULINA PAUPERATA Parker and Jones.

(Plate 74, fig. 3.)

Thin, flat, and transparent, composed of fifteen to twenty or more slightly inflated segments, arranged in about two planospiral convolutions, all the segments being visible on both sides; margin extended into a broad, thin wing of clear shell-substance entirely surrounding the final convolution. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch), often much greater.

Locality.—Specimens from the Gulf of Mexico (stations 2385, 2395), 730 and 347 fathoms.

PULVINULINA KARSTENI Reuss.

(Plate 74, fig. 5.)

Lenticular, about equally convex on both faces, smooth and regular, with a blunt angular peripheral margin, composed of about three convolutions, the last having five or six segments; sutures often indistinctly marked superiorly, well-defined, and a little depressed on the inferior face; aperture as usual, a narrow slit on the inner margin of the final segment. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—North Atlantic (station 2212), 428 fathoms.

PULVINULINA ELEGANS d'Orbigny.

(Plate 75, fig. 1.)

Lenticular, about equally convex on the two sides, smooth; peripheral margin rounded; sutures well marked but not elevated or depressed; walls clear, transparent, and beautifully marked by opaque-white, broad, wavy lines and irregular dots; aperture at the inner margin of the final segment, a second aperture is found in most specimens as a linear slit just beneath the peripheral margin of the last segment. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—Gulf of Mexico, North Atlantic, and Panama Bay (stations 2352, 2394, 2570, 2805), 51 to 1,813 fathoms.

PULVINULINA PARTSCHIANA d'Orbigny.

(Plate 75, fig. 3.)

Differs from *P. elegans* in its smaller size, the tendency to limbation of the sutures, and especially in the absence of the variegated markings which give the specific name to the former species. Diameter, about 0.75 mm. ($\frac{1}{32}$ inch).

Locality.—Gulf of Mexico (station 2394), 420 fathoms.

Genus ROTALIA.

Test rotaliform, shell-wall very finely porous; exogenous deposit either in the form of embossed septal lines or of granulation of the sutures near the umbilicus. Aperture a neatly arched slit, nearly median.

ROTALIA BECCARII Linnæus.

(Plate 75, fig. 2.)

Double-convex, with convexity greatest on the inferior face; margin rounded and slightly lobulated; segments numerous, arranged in about four convolutions, only the last visible on the under side; upper surface smooth; septa on inferior face more or less raised and granular, in some cases double, with a deep fissure between the layers; umbilicus sometimes excavated, sometimes filled with clear shell-substance; walls thick and strong. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Not recorded.

ROTALIA ORBICULARIS d'Orbigny.

(Plate 75, fig. 5.)

Superior face flat or slightly convex, inferior face moderately and regularly convex; umbilicus scarcely if at all depressed; peripheral margin rounded; walls finely porous; surface smooth, without ornamentation; segments numerous, twelve or more in the final convolution; sutures conspicuous because of the thickening of the septal walls; orifice regular. Diameter, about 0.8 mm. ($\frac{1}{30}$ inch).

Locality.—Coast of Oregon (station 3080), 93 fathoms.

ROTALIA SOLDANII d'Orbigny.

(Plate 75, fig. 4.)

Superior face flat and smooth; inferior face highly convex; umbilicus deeply excavated; peripheral margin thick and well rounded; walls very finely perforated, surface smooth except the granular umbilicus; face of the final segment broad and flat. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—A deep-water species, widely distributed. Specimens from North Atlantic, Gulf of Mexico, and North Pacific (stations 2115, 2228, 2550, 2568, 2570, 2385, 2394, 3080).

ROTALIA SCHROETERIANA Parker and Jones.

(Plate 76, fig. 1.)

A large, strong, symmetrical shell, slightly convex on the upper face, highly convex below; sutures broad and conspicuously marked on both faces by numerous prominent beads of clear shell-substance; umbilicus filled with a dense irregular mass of shell. Section near the superior face has opened all the chambers; cross section shows the umbilical mass of shell-substance. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Locality.—Not recorded.

ROTALIA PAPILLOSA Brady.

(Plate 76, fig. 2.)

Test lenticular, nearly equally convex on the two faces; segments clearly defined on both faces by thick septa of transparent shell-substance more or less regularly penetrated by round apertures sometimes running into short fissures. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Locality.—Not recorded.

ROTALIA PULCHELLA d'Orbigny.

(Plate 76, fig. 3.)

Small, much compressed on both faces, composed of numerous somewhat inflated segments arranged in three or four convolutions, only the last convolution visible on the underside; sutures raised in narrow, sometimes interrupted ridges. Projecting radially from the margin are three or four long slender spines, equaling or exceeding in length, when unbroken, the greatest diameter of the test. Diameter, about 0.4 mm. ($\frac{1}{60}$ inch).

Locality.—Not recorded.

Genus TRUNCATULINA.

Test free or adherent, rotaliform, the inferior face generally more convex than the superior; shell-wall coarsely porous; aperture a curved slit at or near the superior margin of the inner edge of the final segment, sometimes with a phialine neck and lip.

TRUNCATULINA LOBATULA Walker and Jacob.

(Plate 76, fig. 4.)

Planoconvex, the convexity on the inferior face; peripheral margin rounded; segments rather numerous, only the final convolution visible below; walls stout and coarsely porous; sutures thickened with clear shell-substance and more or less limbate near the umbilici; aperture a long fissure at the upper and inner margin of the last segments. Diameter, from 0.8 to 1.2 mm ($\frac{1}{30}$ to $\frac{1}{20}$ inch).

Locality.—Bahia, Brazil (station 2760), 1,019 fathoms.

TRUNCATULINA WUELLERSTORFI Schwager.

(Plate 77, fig. 1.)

Outline circular, much compressed, inferior face moderately convex, superior face flat or slightly concave, peripheral margin sharp; composed of numerous narrow curved segments arranged in about three convolutions; walls coarsely porous; aperture regular. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—Gulf of Mexico, North Atlantic, and Panama Bay (stations 2150, 2370, 2392, 2570, 2565, 2750, 2805), 25 to 2,069 fathoms.

TRUNCATULINA UNGERIANA d'Orbigny.

(Plate 77, fig. 2.)

Nearly equally convex on the two surfaces, peripheral margin thin. Differs from *T. wuellerstorfi* in that the superior face is convex, the segments shorter and less curved, and the walls less coarsely porous.

Localities.—Gulf of Mexico and coast of Brazil (stations 2078, 2393, 2400, 2760), 169 to 1,019 fathoms.

TRUNCATULINA AKNERIANA d'Orbigny.

(Plate 77, fig. 5.)

Circular, compressed, superior surface flat, inferior convex at the margin, flat toward the center; margin rounded; a more or less deep and extended fissure on the superior face between the last convolution and the preceding one. Section shows the chambers of the last convolution and a portion of the next. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—Gulf of Mexico and coast of Brazil (stations 2377, 2394, 2398, 2760), 210 to 1,019 fathoms.

TRUNCATULINA ROBERTSONIANA Brady.

(Plate 77, fig. 3.)

Superior surface nearly flat, inferior convex, but flattened toward the center; margin thick and rounded; walls quite transparent, showing clearly the convolutions and the outlines of the numerous segments; all the convolutions visible on the upper face, on the lower

face the final convolution leaves exposed some of the earlier segments; walls coarsely porous; color often a more or less deep shade of brown. Diameter, about 0.7 mm. ($\frac{1}{36}$ inch).

Localities.—North Atlantic, Gulf of Mexico, Caribbean Sea, coast of Brazil (stations 2568, 2352, 2392, 2394, 2760), 463 to 1,781 fathoms.

TRUNCATULINA TENERA Brady.

(Plate 77, fig. 4.)

Small, discoidal, inferior face the more convex; peripheral margin acute and slightly lobulated; visible segments on the inferior face six or seven; convolutions about three of nearly equal width; sutures slightly depressed, straight and radial; aperture a short curved fissure with thickened lip, at the inner margin of the final segment. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—West coast of Patagonia (station 2784), 194 fathoms.

TRUNCATULINA PYGMÆA Hantken.

(Plate 77, fig. 6.)

Very small, slightly convex superiorily, quite convex inferiorily, and depressed at the center; rounded near the margin, but with a rather sharp edge; sutures sometimes thickened with clear shell substance. Diameter, about 0.36 mm. ($\frac{1}{70}$ inch).

Locality.—Gulf of Mexico (station 2460), 169 fathoms.

TRUNCATULINA ROSEA d'Orbigny.

(Plate 78, fig. 2.)

Superior face short conical, with rounded apex; inferior face flat or slightly convex; sutural lines very indistinct; color pink to bright rose color. Section shows chambers of the last convolution, and the thick deposit of pink shell substance about the center of the coil. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—Not recorded.

TRUNCATULINA PRÆCINCTA Karrer.

(Plate 78, fig. 1.)

Comparatively large, thick, biconvex, convexity greatest on the inferior side; margin obtuse; sutures raised by a thick deposit of clear shell substance, especially on the lower side and near the umbilicus. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—Gulf of Mexico (stations 2399, 2400), 169 and 196 fathoms.

TRUNCATULINA RETICULATA Czjzek.

(Plate 78, fig. 3.)

Biconvex, the convexity about equal on the two sides; margin thin and broadly carinate; walls thick, transparent, and rather coarsely perforated along the borders of the segments. The tubuli, in certain

aspects, give a fringed appearance to the margins of the segments. Aperture at the end of a short, oval, tubular neck, with a broad, everted edge. Diameter, about 0.5 mm. ($\frac{1}{50}$ inch).

Locality.—Gulf of Mexico (station 2352), 463 fathoms.

Genus ANOMALINA.

Characters similar to those of *Truncatulina*, except that the two faces are more nearly alike, the general contour being biconcave or subnautiloid, and the whole more or less evolute.

ANOMALINA AMMONOIDES Reuss.

(Plate 78, fig. 4.)

Symmetrical, about equally convex on the two faces, a little depressed at the umbilici, margin rounded; segments numerous, in three or four convolutions; sutures thickened with clear shell substance, sometimes a little raised; walls rather coarsely perforate; aperture in the middle line at the end of the last segment. Section has laid open every chamber of all the convolutions. Diameter, about 0.8 mm. ($\frac{1}{32}$ inch).

Locality.—Collected in large numbers off the west coast of Cuba (station 2352), 463 fathoms.

ANOMALINA GROSSERUGOSA Gümbel.

(Plate 78, fig. 5.)

Less symmetrical than *A. ammonoides*, superior face more compressed, segments fewer, and only those of the final convolution, about seven in number, visible on the inferior face. Diameter, about 1 mm. ($\frac{1}{25}$ inch).

Localities.—Gulf of Mexico and coast of Brazil (stations 2394, 2760), 420 and 1,019 fathoms.

ANOMALINA ARIMINENSIS d'Orbigny.

(Plate 79, fig. 1.)

Very much compressed, thin, margin square, with rounded angles; some of the earlier segments visible on the inferior face; sutures thick and sometimes prominent; walls transparent, distinctly showing outlines of segments and convolutions. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Caribbean Sea (stations 2150, 2355), 382 and 399 fathoms.

ANOMALINA CORONATA Parker and Jones.

(Plate 79, fig. 2.)

Irregularly biconvex, the under side less convex than the upper, depressed at the center on both sides, often more or less distorted, the segments of the last convolution rapidly increasing in breadth, forming an irregular ridge around the border of each face; walls very coarsely porous. Diameter, about 0.25 mm. ($\frac{1}{20}$ inch).

Locality.—Off coast of Georgia (station 2416), 276 fathoms.

ANOMALINA POLYMORPHA Costa.

(Plate 79, fig. 3.)

Strongly resembles *A. coronata*, but is characterized by the presence of one or several short, stout spinous outgrowths, usually from the periphery of the shell. If but one spine is present, that is generally a prolongation of the final segment.

Locality.—Collected at the same station as *A. coronata*.

Genus RUPERTIA.

Test columnar, growing attached by a slightly-spreading base; segments numerous, spirally arranged; aperture at the inner margin of the final segment.

RUPERTIA STABILIS Wallich.

(Plate 79, fig. 4.)

Irregularly flask-shaped, having a moderately-inflated body, a short, thick neck, and an expanded lip. The lip is formed by the spreading base by which the shell adheres to some other body. The neck is formed by about two superimposed convolutions; the body by the inflated segments of the succeeding convolutions; walls thick and coarsely perforated; aperture at the inner edge of the final segment. Length, 1.5 mm. ($\frac{1}{16}$ inch), more or less.

Localities.—North Atlantic and Gulf of Mexico (stations 2530, 2383), 956 and 1,181 fathoms.

Subfamily TINOPORINÆ.

Test consisting of irregularly-heaped chambers, with a more or less distinctly spiral primordial portion.

Genus GYPSINA.

Test free or attached, spheroidal or spreading; structure acervuline, radiating, or laminated; chambers rounded or polyhedral, coarsely perforated.

GYPSINA INHÆRENS Schultze.

(Plate 79, fig. 6.)

Adherent; contour discoidal, more or less distorted according to the form of the surface to which it was adherent; composed of numerous subglobular segments irregularly heaped together, except at the very beginning, where a brief spiral arrangement is perceptible on the under side; walls coarsely perforated; no general aperture. Diameter, about 1.25 mm. ($\frac{1}{20}$ inch).

Localities.—Off Florida Keys, Straits of Yucatan, and Exuma Sound (stations 2641, 2358, 2629), 60 to 1,169 fathoms.

Family X. NUMMULINIDÆ.

Test calcareous and finely tubulated; typically free, polythalamous and symmetrically spiral. The higher modifications all possessing a supplemental skeleton and a canal system of greater or less complexity.

Subfamily POLYSTOMELLINÆ.

Test bilaterally symmetrical; nautiloid, lower forms without supplemental skeleton or interseptal canals; higher types with canals opening at regular intervals along the external septal depressions.

Genus NONIONINA.

Supplemental skeleton absent or rudimentary; no external septal pores or bridges; aperture a simple curved slit.

NONIONINA BOUEANA d'Orbigny.

(Plate 79, fig. 5.)

Oval, compressed, bilaterally symmetrical; composed of numerous long, narrow, curved segments coiled in a close flat spiral, the last convolution completely inclosing the others; outline smooth; sutures flush; surface granular about the umbilici, which are depressed; no interseptal pores. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Locality.—Gulf of Tokyo, 9 fathoms.

NONIONINA SCAPHA Fichtel and Moll.

(Plate 80, fig. 1.)

Oval, compressed, symmetrical, smooth, not granular about the umbilici; segments comparatively few, increasing rapidly in size; face of the terminal segment broad and round. Diameter, about 0.4 mm. ($\frac{1}{60}$ inch).

Localities.—Panama Bay, coast of Yucatan, and Gulf of Tokyo (stations 2805, 2358), 9 to 222 fathoms.

Genus POLYSTOMELLA.

Supplemental skeleton, septal bridges, and canal system more or less fully developed; canals opening externally at the umbilicus and by a single or double row of pores along the sutures. Aperture a V-shaped line of perforations at the base of the septal face.

POLYSTOMELLA STRIATOPUNCTATA Fichtel and Moll.

(Plate 80, fig. 2.)

Discoidal, bilaterally symmetrical; final convolution incloses all the others; margin rounded; walls finely perforated; septal bridges distinct; a single row of pores along the sutures. Diameter, about 0.6 mm. ($\frac{1}{40}$ inch).

Localities.—Coast of Yucatan, North Atlantic (stations 2358, 2530, 2614), 10 to 956 fathoms.

POLYSTOMELLA CRISPA Linnæus.

(Plate 80, fig. 3.)

Lenticular, strongly biconvex, peripheral margin angular; septal pores in a single row, large, and closely set; umbilici filled with clear shell-substance more or less porous. Diameter, about 0.7 mm. ($\frac{1}{35}$ inch)

Locality.—Not recorded.

Subfamily NUMMULITINÆ.

Test lenticular or complanate; lower forms with thickened and finely tubulated shell-wall, but no intermediate skeleton; higher forms with interseptal skeleton and complex canal system.

Genus AMPHISTEGINA.

Test spiral, lenticular, inequilateral; chambers equitant, the alar prolongations on one side simple, on the other divided by deep constrictions so as to form supplementary lobes. Shell-wall thickened near the umbilicus and finely tubulated, but presenting no true canal system.

AMPHISTEGINA LESSONII d'Orbigny.

(Plate 80, fig. 4.)

Lenticular, somewhat unequally convex on the two sides; margin angular; surface smooth; segments numerous, narrow, bent, simple on the upper side, but constricted on the inferior side, and sharply bent backward; aperture on the under side of the last segment. Diameter, about 1.5 mm. ($\frac{1}{16}$ inch).

Localities.—North Atlantic, coast of Yucatan, Gulf of Mexico (stations 2415, 2629, 2641, 2363, 2370), 9 to 1,169 fathoms.

List of stations quoted, location, and depth of water.

Station.	Latitude.	Longitude.	Depth.	Locality.
	° ′	° ′	*Fathoms.*	
2040	38 35	68 16	2,226	Off Nantucket Shoals.
2041	39 22	68 25	1,608	Do.
2115	35 49	74 34	843	Off Cape Hatteras.
2117	15 24	63 31	683	Near Aves Island.
2144	9 49	79 31	896	Near Aspinwall.
2150	13 34	81 21	382	Near Old Providence Island.
2171	37 59	73 48	444	Off Maryland.
2204	39 30	71 44	728	South of Block Island.
2212	39 59	70 30	428	South of Marthas Vineyard.
2221	39 05	70 44	1,525	Do.
2225	36 05	69 51	2,512	Off North Carolina.
2228	37 25	73 06	1,582	Off Maryland.
2234	39 09	72 03	810	South of Long Island.
2242	40 15	70 27	58	South of Marthas Vineyard.
2243	40 10	70 26	63	Do.
2251	40 22	69 51	43	Off Nantucket Shoals.
2252	40 28	69 51	38	Do.
2263	37 08	74 33	430	Off Chesapeake Bay.
2264	37 07	74 34	167	Do.
2289	35 22	75 25	7	Off Cape Hatteras.
2312	32 54	77 53	88	Off South Carolina.
2313	32 53	77 53	99	Do.
2315	24 26	81 48	37	Off Key West, Florida.
2335	23 10	82 20	204	Off Habana, Cuba.
2338	23 10	82 20	189	Do.
2343	23 11	82 19	279	Do.
2352	22 35	84 23	463	Off west coast of Cuba.
2353	20 59	86 23	167	Arrowsmith Bank, Yucatan
2354	20 59	86 23	130	Do.
2355	20 56	86 27	399	Do.
2358	20 19	87 03	222	Off Cozumel Island, Yucatan.
2363	22 07	87 06	21	Off Cape Catoche, Yucatan.
2370	29 18	85 32	25	Between Delta of Mississippi River and Cedar Keys, Florida.
2372	29 15	85 29	27	Do.
2374	29 11	85 29	26	Do.
2377	29 07	88 08	210	Do.
2378	29 14	88 09	68	Do.
2379	28 00	87 42	1,467	Do.
2380	28 02	87 43	1,430	Do.
2382	28 19	88 01	1,255	Do.
2383	28 32	88 06	1,181	Do.
2385	28 51	88 18	730	Do.
2392	28 47	87 27	724	Do.
2394	28 38	87 02	420	Do.
2395	28 36	86 50	347	Do.
2398	28 45	86 26	227	Do.
2399	28 44	86 18	190	Do.
2400	28 41	86 07	169	Do.
2415	30 44	79 26	440	Off Georgia.

List of stations quoted, location, and depth of water—Continued.

Station.	Latitude.		Longitude.		Depth.	Locality.
	°	′	°	′	*Fathoms.*	
2416	31	26	79	07	276	Off Georgia.
2420	37	03	74	31	104	Off Chesapeake Bay.
2530	40	53	66	24	956	Southeast of Georges Bank.
2547	39	54	70	20	390	South of Marthas Vineyard.
2550	39	44	70	30	1,081	Do.
2565	38	19	69	02	2,069	About 220 miles southeast of Marthas Vineyard.
2568	39	15	68	08	1,781	About 200 miles southeast of Marthas Vineyard.
2569	39	26	68	03	1,782	Do.
2570	39	54	67	05	1,813	Southeast of Georges Bank.
2571	40	09	67	09	1,356	Do.
2576	41	15	68	15	18	Georges Bank.
2577	41	17	68	21	32	Do.
2584	39	05	72	23	541	South of Block Island.
2586	39	02	72	40	328	Do.
2614	34	09	76	02	168	Off Cape Lookout.
2616	33	42	77	31	17	Off Cape Fear.
2623	33	38	77	36	15	Do.
2627	32	21	77	07	437	Off Cape Romain.
2629	32	48	75	10	1,169	Mouth of Exuma Sound.
2641	25	11	80	10	60	Off Carysfort Light.
2650	23	34	76	34	369	Southeast of Andros Island (Bahamas).
2651	24	02	77	12	97	Do.
2654	27	57	77	27	660	Off Little Bahama Bank.
2655	27	22	78	07	338	Do.
2660	28	40	78	46	504	Off Cape Canaveral.
2662	29	24	79	43	434	Off St. Augustine.
2663	29	39	79	49	421	Do.
2677	32	39	76	50	478	Off Cape Fear.
2679	32	40	76	40	782	Do.
2684	39	35	70	54	1,106	South of Marthas Vineyard.
2716	38	29	70	57	1,631	Do.
2723	36	47	73	09	1,685	Off Chesapeake Bay.
2731	36	45	74	28	781	Do.
2750	18	30	63	31	496	Off Windward Islands, West Indies.
2751	16	54	63	12	687	Do.
2754	11	40	58	33	880	Off Santa Lucia, West Indies.
2760	S. 12	07	37	17	1,019	Off Bahia, Brazil.
2762	S. 23	08	41	34	59	Off Cape Frio, Brazil.
2763	S. 24	17	42	48	671	Do.
2784	S. 48	41	74	24	194	Between Wellington Island and Patagonia.
2805	S. 7	56	79	41	51	Panama Bay.
2842	N. 54	15	166	03	72	Off Head of Akutan Island, Alaska.
2860	51	23	130	34	876	Off Cape St. James, Queen Charlotte Islands.
2923	32	40	117	31	822	Off San Diego, California.
3080	43	58	124	36	93	Off Heceta Bank, Oregon.
3415	14	46	98	40	1,879	West coast of Mexico.

INDEX.

ASTRORHIZA GRANULOSA BRADY. SEE PAGE 265

a Longitudinal Section.

ASTRORHIZA CRASSATINA BRADY. SEE PAGE [illegible].

a. [illegible]

FIG. 1. ASTRORHIZA ANGULOSA BRADY. SEE PAGE 265.

a. Section

FIG. 2. ASTRORHIZA ARENARIA NORMAN. SEE PAGE 265.

a. Section.

FIG. 1. PELOSINA VARIABILIS BRADY. SEE PAGE 266.

FIG. 2. STORTHOSPHAERA ALBIDA SCHULTZE. SEE PAGE 266.

a. Section.

PILULINA JEFFREYSII CARPENTER. SEE PAGE 266.

a. Section

FIG. 1. CRITHIONINA PISUM GOËS. SEE PAGE 266.

a, b. Sections.

FIG. 2. CRITHIONINA PISUM GOËS, VAR. HISPIDUM, NEW. SEE PAGE 267.

a, b. Sections

BATHYSIPHON RUFUM DE FOLIN. [illegible]
[illegible]

FIG. 1. PSAMMOSPHAERA FUSCA BRADY. SEE PAGE 268.

a. *b*. Sections.

FIG. 2. PSAMMOSPHAERA FUSCA BRADY, VAR. TESTACEA, NEW. SEE PAGE 268.

a. Artificial Section. *b*. Accidental Section.

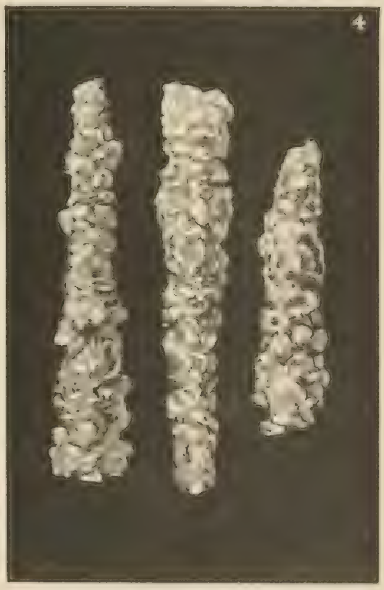


FIG. 1. PSAMMOSPHÆRA PARVA M. SARS. SEE PAGE 268.

a. Adherent Specimen.

FIG. 2. SACCAMMINA SPHERICA M. SARS. SEE PAGE 269.

a. Section.

FIG. 3. SACCAMMINA CONSOCIATA NEW SPECIES. SEE PAGE 269.

a. Adherent to a fragment of shell. *b.* Detached Specim

FIG. 4. JACULELLA ACUTA BRADY. SEE PAGE 269.

FIG. 1. HYPERAMMINA FRIABILIS BRADY. SEE PAGE 269.
FIG. 2. HYPERAMMINA ELONGATA BRADY. SEE PAGE 270.

FIG. 1. HYPERAMMINA RAMOSA BRADY. SEE PAGE 270.

FIG. 2. HYPERAMMINA VAGANS BRADY. SEE PAGE 270.

a. Specimen attached to fragment of Shell of M[illegible]

b Specimen coiled around fragment of Rhabdammina

FIG. 1. MARSIPELLA ELONGATA NORMAN. SEE PAGE 270.
FIG. 2. RHABDAMMINA ABYSSORUM M. SARS. SEE PAGE 271.
a. Section.

RHABDAMMINA DISCRETA BRADY. SEE PAGE 271.

FIG. 1. RHABDAMMINA LINEARIS BRADY. SEE PAGE 271.
FIG. 2. RHABDAMMINA CORNUTA BRADY. SEE PAGE 271.

FIG. 1. RHIZAMMINA ALGÆFORMIS BRADY. SEE PAGE 272.
FIG 2. RHIZAMMINA INDIVISA BRADY. SEE PAGE 272.

FIG. 1. REOPHAX DIFFLUGIFORMIS BRADY, VAR. TESTACEA, NEW. SEE PAGE 273.

a. Longitudinal Section.

FIG. 2. REOPHAX DIFFLUGIFORMIS BRADY. SEE PAGE 272.

FIG. 3. REOPHAX SCORPIURUS MONTFORT. SEE PAGE 273.

FIG. 1. REOPHAX SCORPIURUS MONTFORT. SEE PAGE 273.
FIG. 2. REOPHAX BILOCULARIS NEW SPECIES. SEE PAGE 273.

FIG. 1. REOPHAX PILULIFERA BRADY. SEE PAGE 273.
FIG. 2. REOPHAX DENTALINIFORMIS BRADY. SEE PAGE 274.
FIG. 3. REOPHAX BACILLARIS BRADY. SEE PAGE 274.
FIG. 4. REOPHAX NODULOSA BRADY. SEE PAGE 274.
a. Longitudinal Section
FIG. 5. REOPHAX ADUNCA BRADY. SEE PAGE 274.
FIG. 6. REOPHAX CYLINDRICA BRADY. SEE PAGE 274.

FIG. 1. HAPLOPHRAGMIUM CALCAREUM BRADY. SEE PAGE 275.

a. Longitudinal Section.

FIG. 2. HAPLOPHRAGMIUM AGGLUTINANS BRADY. SEE PAGE 275.

FIG. 3. HAPLOPHRAGMIUM TENUIMARGO BRADY. SEE PAGE 275.

FIG. 4. HAPLOPHRAGMIUM CASSIS PARKER. SEE PAGE 275.

FIG. 5. HAPLOPHRAGMIUM EMACIATUM BRADY. SEE PAGE 276.

FIG. 6. HAPLOPHRAGMIUM FOLIACEUM BRADY. SEE PAGE 276.

FIG. 1. HAPLOPHRAGRMIUM LATIDORSATUM BORNEMANN. SEE PAGE 276.

a. Section.

FIG. 2. HAPLOPHRAGRMIUM SCITULUM BRADY. SEE PAGE 276.

a. Section.

FIG. 3. HAPLOPHRAGRMIUM CANARIENSE D'ORBIGNY. SEE PAGE 277.

FIG. 1. HAPLOPHRAGMIUM GLOBIGERINIFORME PARKER & JONES. SEE PAGE 277.

FIG. 2. THURAMMINA FAVOSA NEW SPECIES. SEE PAGE 278.

a. Section.

FIG. 3. HAPLOSTICHE SOLDANII JONES & PARKER. SEE PAGE 277.

a. Longitudinal Section.

FIG. 1. THURAMMINA PAPILLATA BRADY. SEE PAGE 278.

a. Accidental Section

FIG. 2. THURAMMINA CARIOSA NEW SPECIES. SEE PAGE 278.

a. Section

FIG. 1. AMMODISCUS TENUIS BRADY. SEE PAGE 279.

a. Section

FIG. 2. AMMODISCUS INCERTUS D'ORBIGNY. SEE PAGE 278.

a. Section

FIG. 1. AMMODISCUS GORDIALIS JONES & PARKER. SEE PAGE 279.
FIG. 2. AMMODISCUS CHAROIDES JONES & PARKER. SEE PAGE 279
FIG. 3. WEBBINA CLAVATA JONES & PARKER. SEE PAGE 279.
a. Detached Specimen showing adherent face
FIG. 4. HORMOSINA GLOBULIFERA BRADY. SEE PAGE 280.
a. Longitudinal Section.

FIG. 1. HORMOSINA CARPENTERI BRADY. SEE PAGE 280.

a. Longitudinal Section.

FIG. 2. HORMOSINA OVICULA BRADY. SEE PAGE 280.

FIG. 3. TROCHAMMINA PROTEUS KARRER. SEE PAGE 281.

FIG. 1. TROCHAMMINA LITUIFORMIS BRADY. SEE PAGE 281.
FIG. 2. TROCHAMMINA CONGLOBATA BRADY. SEE PAGE 281.
FIG. 3. TROCHAMMINA CORONATA BRADY. SEE PAGE 281.

Fig. 1. TROCHAMMINA RINGENS Brady. See Page [illegible].
Fig. 2. TROCHAMMINA PAUCILOCULATA Brady. See Page [illegible].
Fig. 3. CYCLAMMINA CANCELLATA Brady. See Page [illegible].
a. Section.

FIG. 1. CYCLAMMINA CANCELLATA BRADY. SMALL AND SMOOTH VARIETY. SEE PAGE 282.
a. Section.

FIG. 2. CYCLAMMINA PUSILLA BRADY. SEE PAGE 282.
a. Section.

FIG. 3. TEXTULARIA QUADRILATERA SCHWAGER. SEE PAGE 283.

FIG. 4. TEXTULARIA TRANSVERSARIA BRADY. SEE PAGE 283.

FIG. 5. TEXTULARIA CONCAVA KARRER. SEE PAGE 283.






FIG. 1. TEXTULARIA CARINATA D'ORBIGNY. SEE PAGE 2[illegible]4.
FIG. 2. TEXTULARIA RUGOSA REUSS. SEE PAGE 2[illegible]4.
FIG. 3. TEXTULARIA LUCULENTA BRADY. SEE PAGE [illegible].
FIG. 4. TEXTULARIA AGGLUTINANS D'ORBIGNY. SEE PAGE 2[illegible].
FIG. 5. TEXTULARIA GRAMEN D'ORBIGNY. SEE PAGE 2[illegible]4.
FIG. 6. TEXTULARIA CONICA D'ORBIGNY. SEE PAGE 2[illegible]5.

FIG. 1. TEXTULARIA TROCHUS D'ORBIGNY. SEE PAGE 285.
a. Longitudinal Section.
FIG. 2. TEXTULARIA BARRETTII JONES & PARKER. SEE PAGE 285.
a. Longitudinal Section.

FIG. 1. VERNEUILINA PYGMÆA EGGER. SEE PAGE 285.
FIG. 2. VERNEUILINA PROPINQUA BRADY. SEE PAGE 285.
FIG. 3. VALVULINA CONICA PARKER & JONES. SEE PAGE 286.
FIG. 4. BIGENERINA NODOSARIA D'ORBIGNY. SEE PAGE 286.
a. Longitudinal Section

FIG. 1. BIGENERINA ROBUSTA BRADY. SEE PAGE 286.
FIG. 2. BIGENERINA PENNATULA BATSCH. SEE PAGE 287.
FIG. 3. BIGENERINA CAPREOLUS D'ORBIGNY. SEE PAGE 286.
FIG. 4. GAUDRYINA PUPOIDES D'ORBIGNY. SEE PAGE 287.
FIG. 5. GAUDRYINA BACCATA SCHWAGER. SEE PAGE 287.

FIG. 1. GAUDRYINA SUBROTUNDATA SCHWAGER. SEE PAGE 287.
FIG. 2. GAUDRYINA FILIFORMIS BERTHELIN. SEE PAGE [illegible].
FIG. 3. GAUDRYINA RUGOSA D'ORBIGNY. SEE PAGE [illegible].
a. Longitudinal Sect[illegible]

FIG. 1. GAUDRYINA SCABRA BRADY. SEE PAGE 288.
FIG. 2. GAUDRYINA SIPHONELLA REUSS. SEE PAGE 288.
FIG. 3. CLAVULINA COMMUNIS D'ORBIGNY. SEE PAGE 288.
a, b. Longitudinal Sections

FIG. 1. CLAVULINA EOCÆNA GÜMBEL. SEE PAGE 289.

a. Transverse Section

FIG. 2. CLAVULINA PARISIENSIS D'ORBIGNY. SEE PAGE 289.

FIG. 3. CLAVULINA PARISIENSIS D'ORBIGNY. (VAR. COARSE CORAL SAND SEE PAGE 289

a. Longitudinal Sect

5

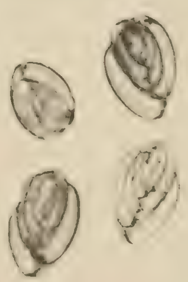


FIG. 1. CLAVULINA PARISIENSIS D'ORBIGNY, VAR. HUMILIS BRADY. SEE PAGE 289.
FIG. 2. CLAVULINA ANGULARIS D'ORBIGNY. SEE PAGE 289.
FIG. 3. BULIMINA ELEGANS D'ORBIGNY. SEE PAGE 290.
FIG. 4. BULIMINA PYRULA D'ORBIGNY. SEE PAGE 290.
FIG. 5. BULIMINA PYRULA D'ORBIGNY. (BY TRANSMITTED LIGHT.

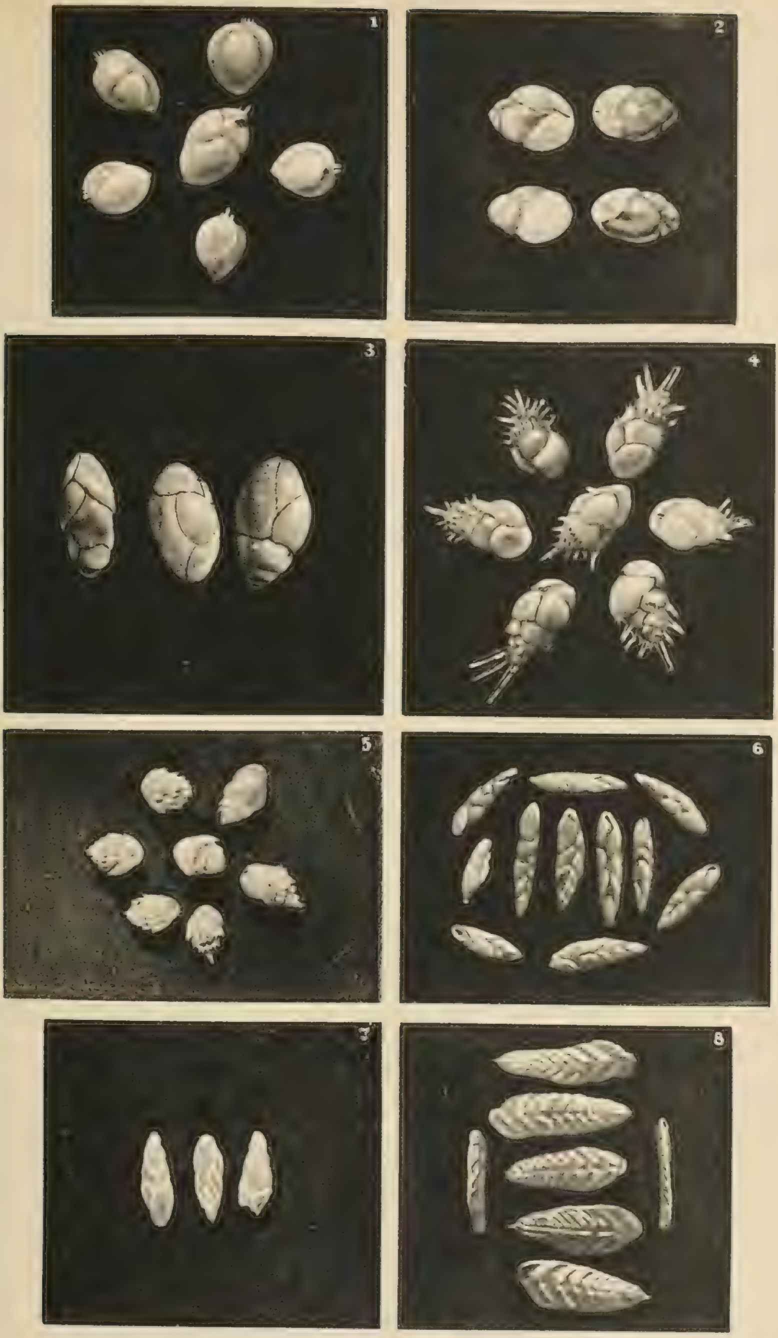


FIG. 1. BULIMINA PYRULA, VAR. SPINESCENS BRADY. SEE PAGE 290.
FIG. 2. BULIMINA AFFINIS D'ORBIGNY. SEE PAGE 290.
FIG. 3. BULIMINA PUPOIDES D'ORBIGNY. SEE PAGE 290.
FIG. 4. BULIMINA ACULEATA D'ORBIGNY. SEE PAGE 291.
FIG. 5. BULIMINA INFLATA SEGUENZA. SEE PAGE 291.
FIG. 6. VIRGULINA SCHREIBERSIANA CZJZEK. SEE PAGE 291.
FIG. 7. VIRGULINA SUBSQUAMOSA EGGER. SEE PAGE 291.
FIG. 8. BOLIVINA ÆNARIENSIS COSTA. SEE PAGE 292.

FIG. 1. BOLIVINA PUNCTATA D'ORBIGNY. SEE PAGE 292.
FIG. 2. BOLIVINA PORRECTA BRADY. SEE PAGE 292.
FIG. 3. CASSIDULINA CRASSA D'ORBIGNY. SEE PAGE 292.
FIG. 4. CASSIDULINA SUBGLOBOSA BRADY. SEE PAGE 293.
FIG. 5. BILOCULINA BULLOIDES D'ORBIGNY. SEE PAGE 293
a. Transverse Section.

FIG. 1. BILOCULINA TUBULOSA COSTA. SEE PAGE 293.

FIG. 2. BILOCULINA RINGENS LAMARCK. SEE PAGE 294.

a. Transverse Section.

FIG. 3. BILOCULINA COMATA BRADY. SEE PAGE 294.

FIG. 4. BILOCULINA ELONGATA EHRENBERG. SEE PAGE 294.

FIG. 1. BILOCULINA DEPRESSA D'ORBIGNY. SEE PAGE 294.

a. Transverse Section.

FIG. 2. BILOCULINA DEPRESSA, VAR. SERRATA BRADY. SEE PAGE 294.

a. Transverse Section.

FIG. 3. BILOCULINA DEHISCENS NEW SPECIES. SEE PAGE 295.

FIG. 1. BILOCULINA LÆVIS DEFRANCE. SEE PAGE 295.

FIG. 2. BILOCULINA SPHÆRA D'OBRIGNY. SEE PAGE 295.

a. Section.

FIG. 3. BILOCULINA IRREGULARIS D'ORBIGNY. SEE PAGE 295.

FIG. 4. SPIROLOCULINA NITIDA D'ORBIGNY. SEE PAGE 296.

FIG. 5. SPIROLOCULINA EXCAVATA D'ORBIGNY. SEE PAGE 296.

FIG. 1. SPIROLOCULINA ROBUSTA BRADY. SEE PAGE 296.

a. Horizontal Section. *b*. Transverse Section.

FIG. 2. SPIROLOCULINA ROBUSTA BRADY. (TRANSITION STAGES FROM BILOCULINA COMPRESSA.) SEE PAGE 296.

FIG. 3. SPIROLOCULINA LIMBATA D'ORBIGNY. SEE PAGE 296.

FIG. 4. SPIROLOCULINA PLANULATA LAMARCK. SEE PAGE 297.

FIG. 1. SPIROLOCULINA ARENARIA BRADY. SEE PAGE 297.
FIG. 2. MILIOLINA SEMINULUM LINNÆUS. SEE PAGE 297.
FIG. 3. MILIOLINA OBLONGA MONTAGU. SEE PAGE 297.
FIG. 4. MILIOLINA CUVIERANA D'ORBIGNY. SEE PAGE 298.
FIG. 5. MILIOLINA GRACILIS D'ORBIGNY. SEE PAGE 297.
FIG. 6. MILIOLINA AUBERIANA D'ORBIGNY. SEE PAGE 298.
a. Transverse Section.

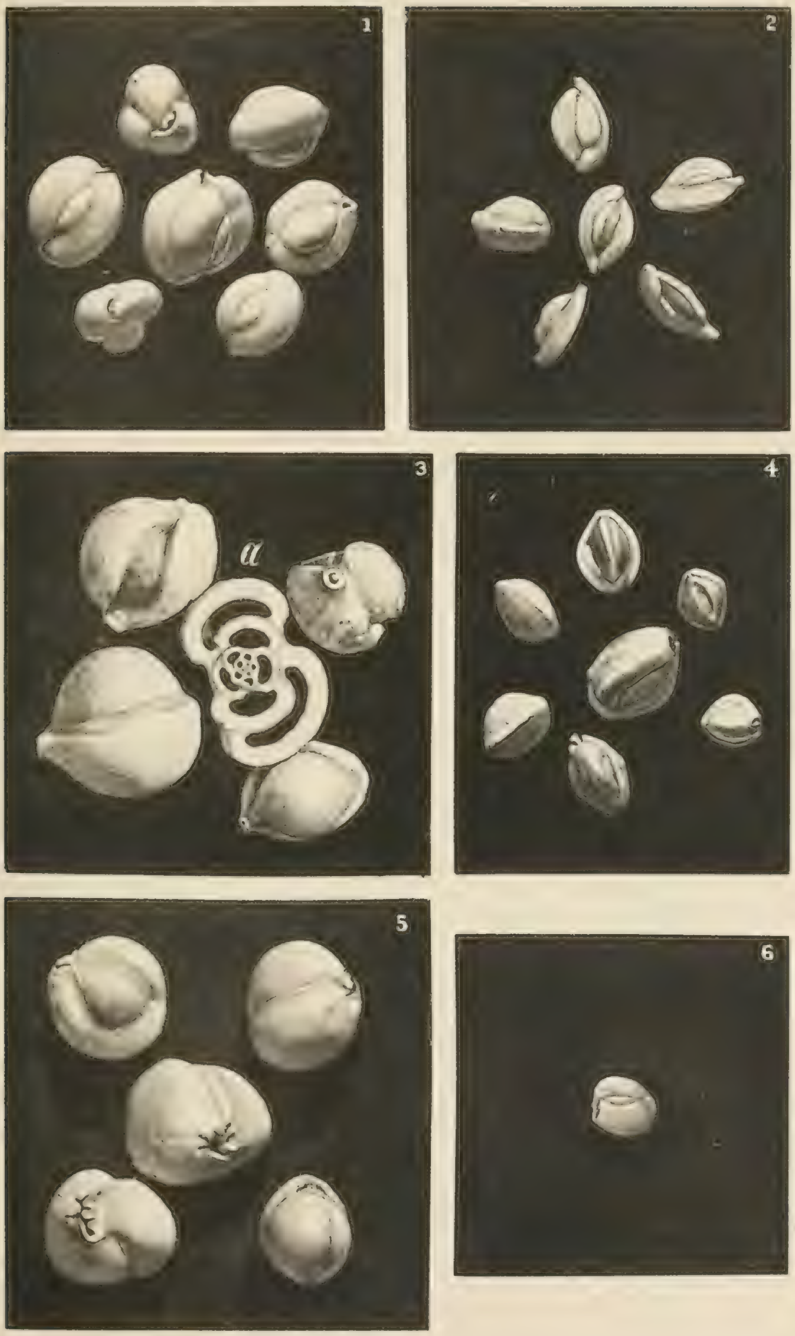


FIG. 1. MILIOLINA CIRCULARIS BORNEMANN. SEE PAGE 298.
FIG. 2. MILIOLINA VENUSTA KARRER. SEE PAGE 298.
FIG. 3. MILIOLINA TRIGONULA LAMARCK. SEE PAGE 298.
a. Transverse Section.
FIG. 4. MILIOLINA TRICARINATA D'ORBIGNY. SEE PAGE 298.
FIG. 5. MILIOLINA VALVULARIS REUSS. SEE PAGE 299.
FIG. 6. MILIOLINA SUBROTUNDA MONTAGU. SEE PAGE 299.

FIG. 1. MILIOLINA BUCCULENTA BRADY. SEE PAGE 299.

FIG. 2. MILIOLINA INSIGNIS BRADY. SEE PAGE 299.

a. Transverse Section.

FIG. 3. MILIOLINA LABIOSA D'ORBIGNY. SEE PAGE 299.

FIG. 4. MILIOLINA UNDOSA KARRER. SEE PAGE 300.

FIG. 1. MILIOLINA ANGULARIS NEW SPECIES. SEE PAGE 300.
FIG. 2. MILIOLINA BICORNIS WALKER & JACOB. SEE PAGE 30[illegible].
FIG. 3. MILIOLINA LINNAEANA D'ORBIGNY. SEE PAGE 3[illegible].
FIG. 4. MILIOLINA PULCHELLA D'ORBIGNY. SEE PAGE 3[illegible]1.
FIG. 5. MILIOLINA RETICULATA D'ORBIGNY. SEE PAGE 3[illegible]1.
FIG. 6. MILIOLINA SEPARANS BRADY. SEE PAGE 300.

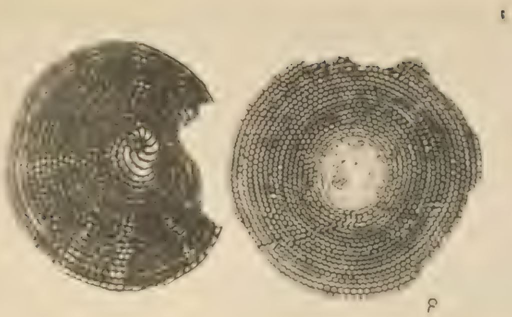
FIG. 1. ARTICULINA SAGRA D'ORBIGNY. SEE PAGE 301.
FIG. 2. MILIOLINA AGGLUTINANS D'ORBIGNY. SEE PAGE 301.
FIG. 3. OPHTHALMIDIUM INCONSTANS BRADY. SEE PAGE 302.
FIG. 4. VERTEBRALINA INSIGNIS BRADY. SEE PAGE 302.
FIG. 5. PLANISPIRINA CELATA COSTA. SEE PAGE 303.
a. Transverse Section.
FIG. 6. PLANISPIRINA SIGMOIDEA BRADY. SEE PAGE 302.
a. Transverse Section

FIG. 1. CORNUSPIRA FOLIACEA PHILIPPI. See Page [illegible].
FIG. 2. CORNUSPIRA CARINATA COSTA. See Page [illegible].
FIG. 3. CORNUSPIRA INVOLVENS REUSS. See Page [illegible].
FIG. 4. PENEROPLIS PERTUSUS FORSKÅL. See Page [illegible].
a [illegible]

FIG. 1. PENEROPLIS PERTUSUS FORSKAL, VAR. DISCOIDEUS, NEW. SEE PAGE 304.
a. Incomplete Section

FIG. 2. PENEROPLIS PERTUSUS FÖRSKAL. (BY TRANSMITTED LIGHT.) SEE PAGE 304.

FIG. 1. ORBICULINA ADUNCA FICHTEL & MOLL. SEE PAGE 304.
FIG. 2. ORBITOLITES MARGINALIS LAMARCK. SEE PAGE 304.



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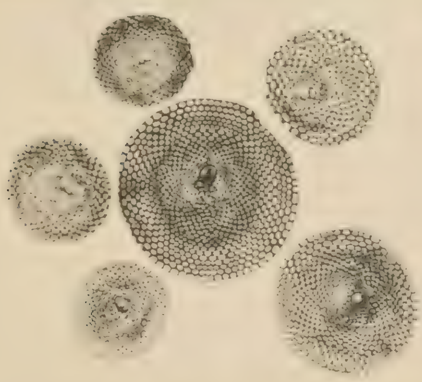


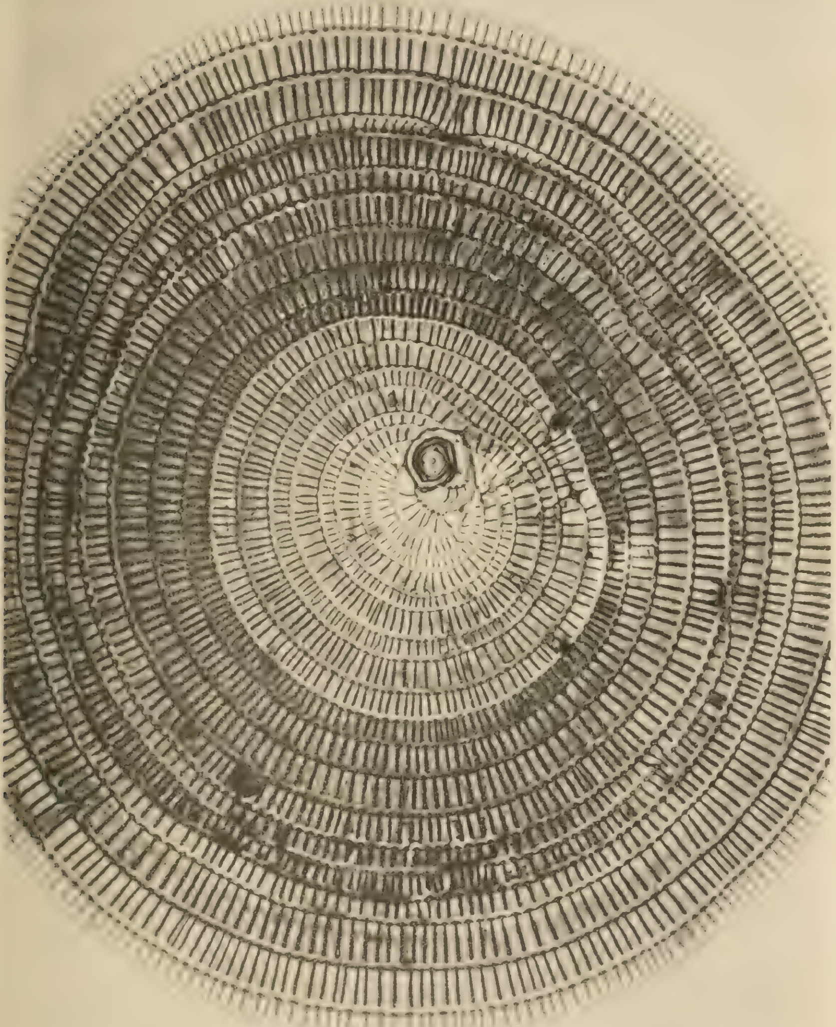
FIG. 1. ORBITOLITES MARGINALIS LAMARCK. (BY TRANSMITTED LIGHT.) SEE PAGE 304.

a. Section.

FIG. 2. ORBITOLITES DUPLEX CARPENTER. SEE PAGE 305.

a, b. Sections.

FIG. 3. ORBITOLITES DUPLEX CARPENTER. (BY TRANSMITTED LIGHT.



ORBITOLITES TENUISSIMA CARPENTER. (BY TRANSMITTED LIGHT.)

SEE PAGE 305.

The shaded portion of the figure is occupied in the specimen by the protoplasmic body of the anima

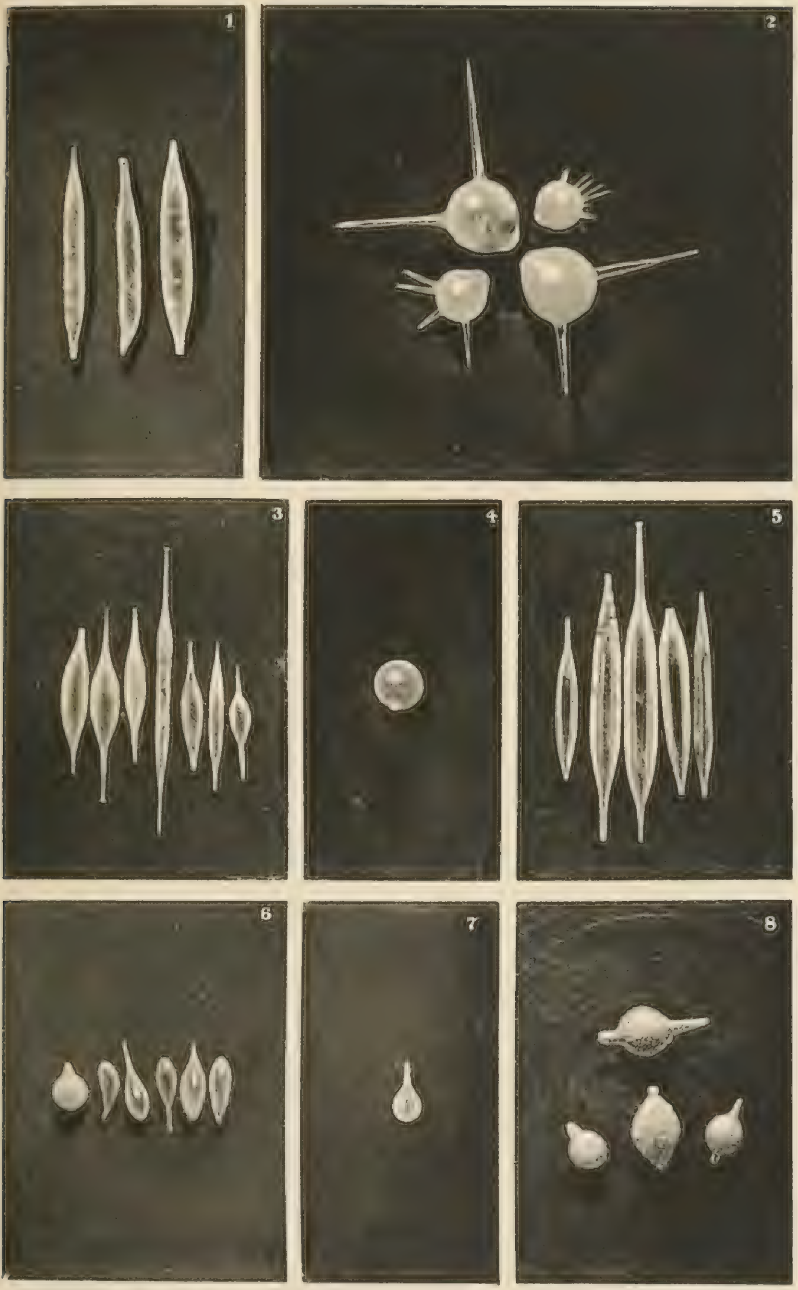


FIG. 1. LAGENA ELONGATA EHRENBERG. SEE PAGE 306.
FIG. 2. LAGENA LONGISPINA BRADY. SEE PAGE 306.
FIG. 3. LAGENA GRACILLIMA SEGUENZA. SEE PAGE 306.
FIG. 4. LAGENA GLOBOSA MONTAGU. SEE PAGE 306.
FIG. 5. LAGENA DISTOMA PARKER & JONES. SEE PAGE 306.
FIG. 6. LAGENA LAEVIS MONTAGU. SEE PAGE 306.
FIG. 7. LAGENA SULCATA WALKER & JACOB. SEE PAGE 307.
FIG. 8. LAGENA HISPIDA REUSS. SEE PAGE 307.

FIG 1. LAGENA STAPHYLLEARIA SCHWAGER. SEE PAGE 307.
FIG. 2. LAGENA MARGINATA WALKER & BOYS. SEE PAGE 307.
FIG. 3. LAGENA CASTANEA NEW SPECIES. SEE PAGE 307.
FIG. 4. LAGENA ORBIGNYANA SEGUENZA. SEE PAGE 308.
FIG. 5. LAGENA CASTRENSIS SCHWAGER. SEE PAGE 308.
FIG. 6. NODOSARIA ROTUNDATA REUSS. SEE PAGE 308.

FIG. 1. NODOSARIA RADICULA LINNÆUS. SEE PAGE 309.
FIG. 2. NODOSARIA SIMPLEX SYLVESTRI. SEE PAGE 309.
FIG. 3. NODOSARIA LÆVIGATA NILSSON. SEE PAGE 308.
FIG. 4. NODOSARIA PYRULA D'ORBIGNY. SEE PAGE 309.
FIG. 5. NODOSARIA FARCIMEN SOLDANI. SEE PAGE 309.
FIG. 6. NODOSARIA FILIFORMIS D'ORBIGNY. SEE PAGE 310.

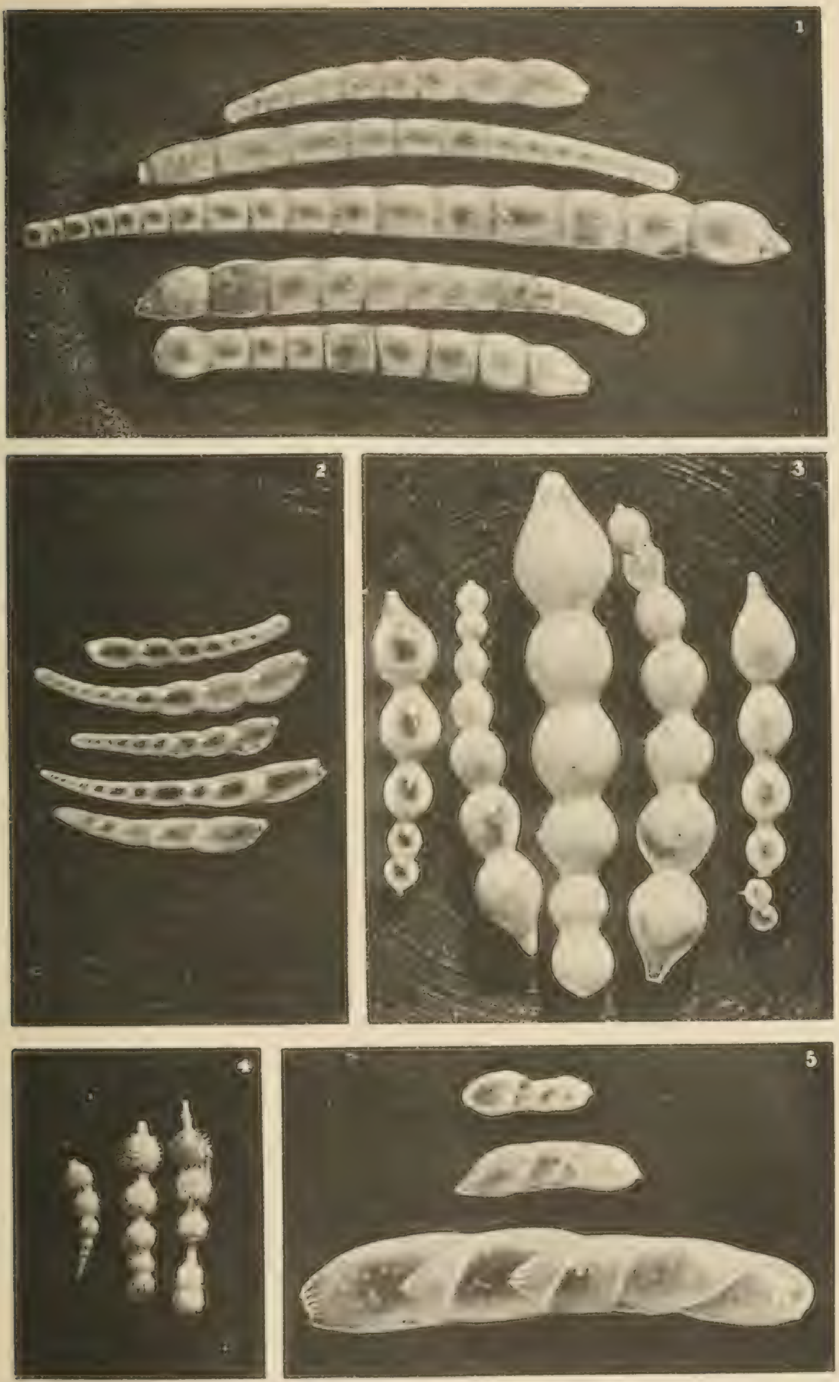


FIG. 1. NODOSARIA CONSOBRINA D'ORBIGNY, VAR. EMACIATA REUSS. SEE PAGE 310.
FIG. 2. NODOSARIA COMMUNIS D'ORBIGNY. SEE PAGE 310.
FIG. 3. NODOSARIA SOLUTA BORNEMANN. SEE PAGE 310.
FIG. 4. NODOSARIA HISPIDA D'ORBIGNY, VAR. SUBLINEATA BRADY. SEE PAGE 311.
FIG. 5. NODOSARIA ROEMERI NEUGEBOREN. SEE PAGE 310.

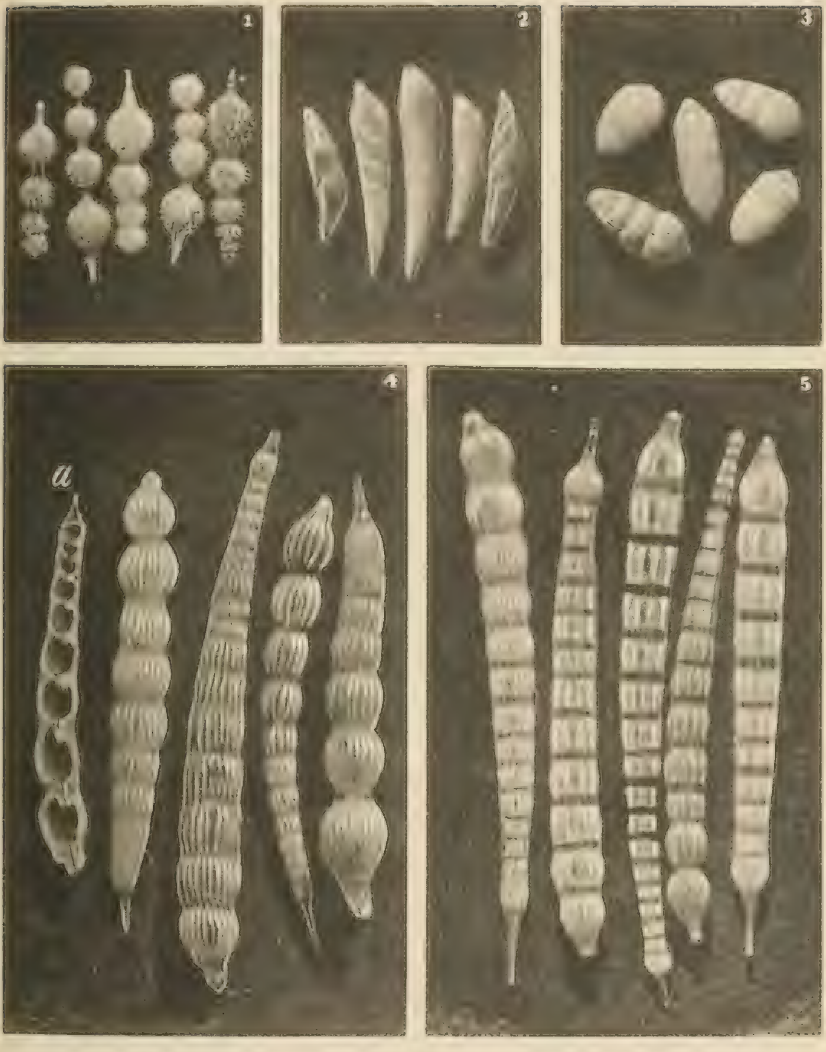


FIG. 1. NODOSARIA HISPIDA D'ORBIGNY. SEE PAGE 311.

FIG. 2. NODOSARIA MUCRONATA NEUGEBOREN. SEE PAGE 311.

FIG. 3. NODOSARIA COMATA BATSCH. SEE PAGE 311.

FIG. 4. NODOSARIA OBLIQUA LINNÆUS. SEE PAGE 311.

a. Longitudinal Section.

FIG. 5. NODOSARIA VERTEBRALIS BATSCH. SEE PAGE 312.

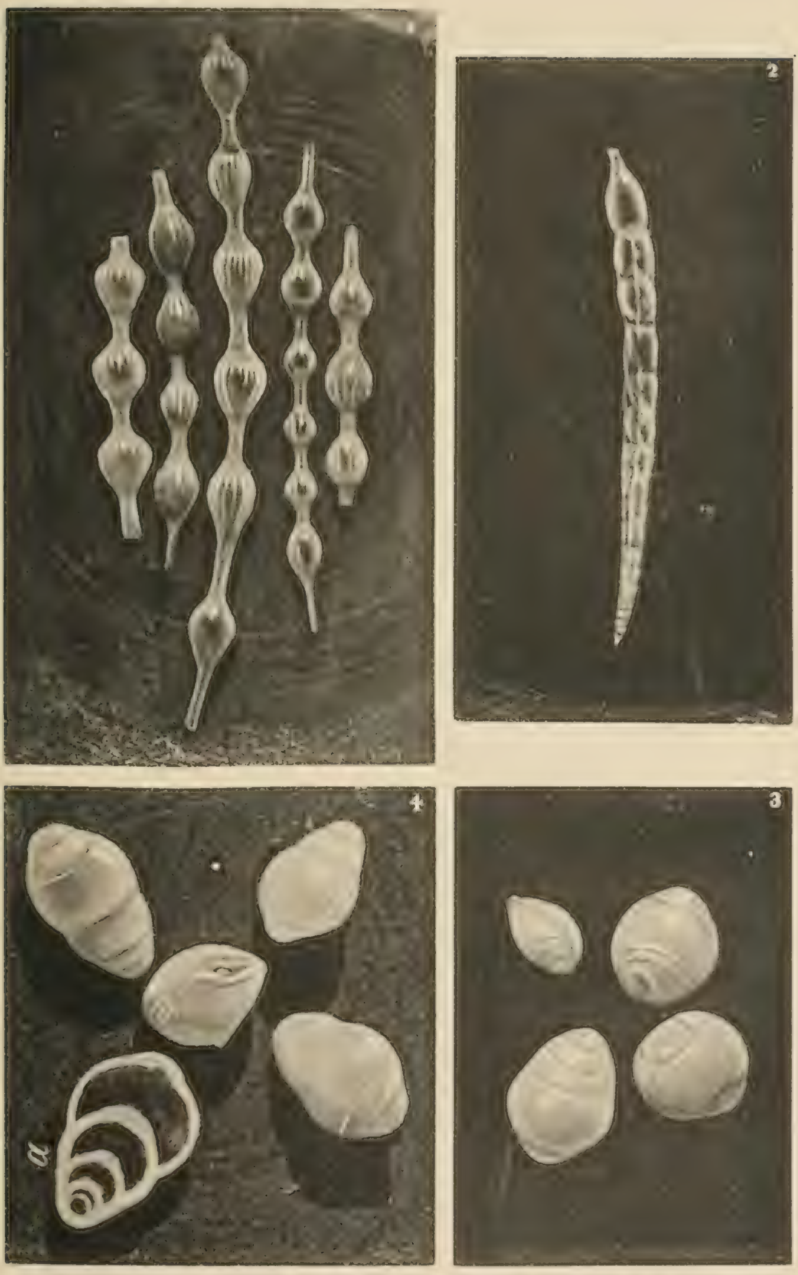


FIG. 1. NODOSARIA COSTULATA REUSS. SEE PAGE 312.

FIG. 2. NODOSARIA CATENULATA BRADY. SEE PAGE 312.

FIG. 3. LINGULINA CARINATA D'ORBIGNY. SEE PAGE 312.

FIG. 4. LINGULINA CARINATA D'ORBIGNY, VAR. SEMINUDA HANTKEN. SEE PAGE 312.

a. Longitudinal Section

FIG. 1. FRONDICULARIA ALATA D'ORBIGNY. SEE PAGE 313.

FIG. 2. FRONDICULARIA INÆQUALIS COSTA. SEE PAGE 313.

FIG. 3. MARGINULINA ENSIS REUSS. SEE PAGE 314.

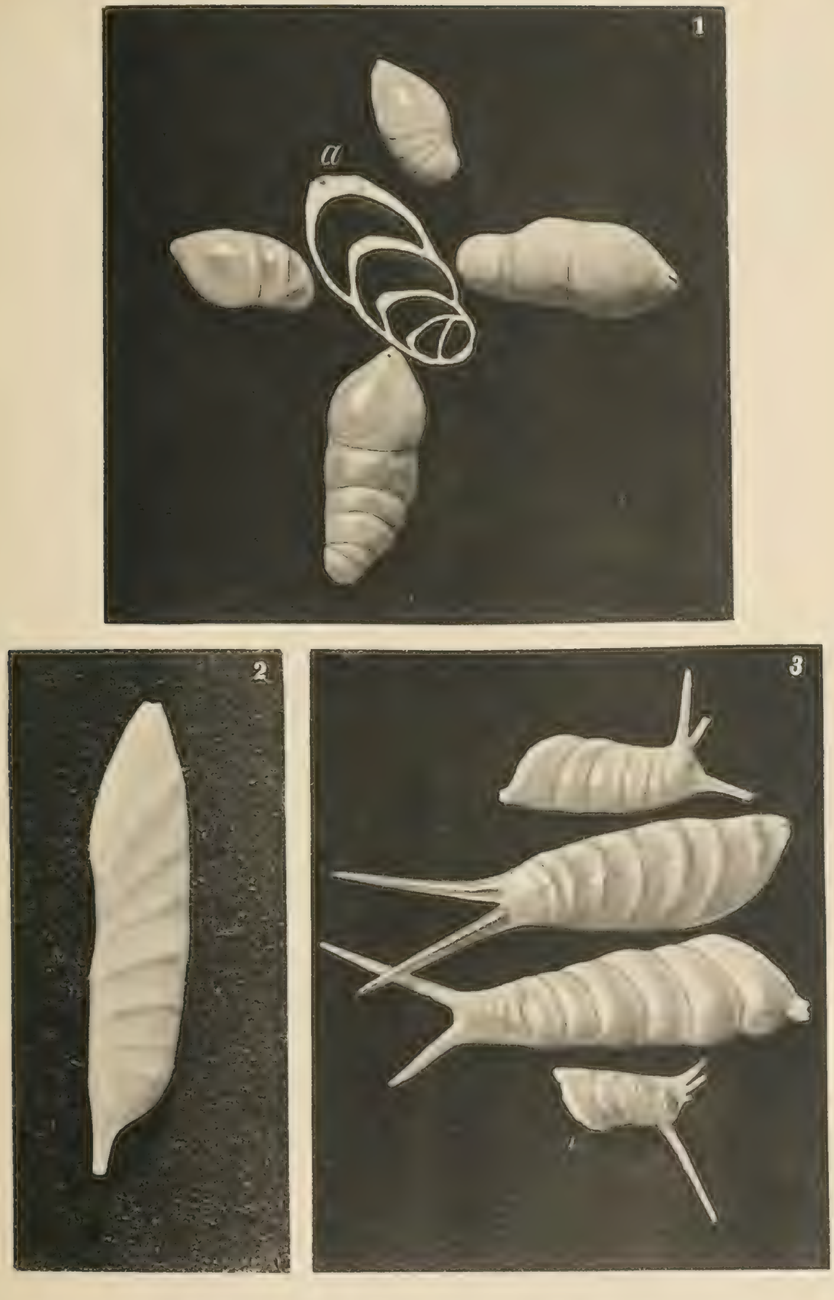


Fig. 1. MARGINULINA GLABRA D'ORBIGNY. See Page [illegible]

[illegible]

Fig. 2. VAGINULINA LEGUMEN LINNAEUS. See Page [illegible]

Fig. 3. VAGINULINA [illegible]. See Page [illegible]

FIG. 1. VAGINULINA LINEARIS MONTAGU. SEE PAGE 314.
FIG. 2. CRISTELLARIA TENUIS BORNEMANN. SEE PAGE 315.
FIG. 3. CRISTELLARIA OBTUSATA REUSS, VAR. SUBALATA BRADY. SEE PAGE 315.

FIG. 1. CRISTELLARIA COMPRESSA D'ORBIGNY. SEE PAGE 315.
FIG. 2. CRISTELLARIA RENIFORMIS D'ORBIGNY. SEE PAGE 315.

FIG. 1. CRISTELLARIA VARIABILIS REUSS. SEE PAGE 316.
FIG. 2. CRISTELLARIA CREPIDULA FICHTEL & MOLL. SEE PAGE 316.
FIG. 3. CRISTELLARIA LATIFRONS BRADY. SEE PAGE 316.
FIG. 4. CRISTELLARIA SCHLOENBACHI REUSS. SEE PAGE 315.
FIG. 5. CRISTELLARIA ACUTAURICULARIS FICHTEL & MOLL. SEE PAGE 316
FIG. 6. CRISTELLARIA ITALICA DEFRANCE. SEE PAGE 316.




FIG. 1. CRISTELLARIA GIBBA D'ORBIGNY. SEE PAGE 317.
FIG. 2. CRISTELLARIA ARTICULATA REUSS. SEE PAGE 317.
FIG. 3. CRISTELLARIA ORBICULARIS D'ORBIGNY. SEE PAGE 317.
FIG. 4. CRISTELLARIA ROTULATA LAMARCK. SEE PAGE 317.
a. Horizontal Section.

FIG. 1. CRISTELLARIA VORTEX FICHTEL & MOLL. SEE PAGE 317.
FIG. 2. CRISTELLARIA CULTRATA MONTFORT SEE PAGE 318.
a. Horizontal Sect

FIG. 1. CRISTELLARIA CALCAR LINNÆUS. SEE PAGE 31[illegible].
FIG. 2. CRISTELLARIA ECHINATA D'ORBIGNY. SEE PAGE 315.
FIG. 3. CRISTELLARIA ACULEATA D'ORBIGNY. SEE PAGE 315.

FIG. 1. CRISTELLARIA LIMBATA NEW SPECIES. SEE PAGE 318.
FIG. 2. POLYMORPHINA SORARIA REUSS. SEE PAGE 319.
FIG. 3. POLYMORPHINA COMPRESSA D'ORBIGNY. SEE PAGE 319.
a. Section.
FIG. 4. POLYMORPHINA ELEGANTISSIMA PARKER & JONES. SEE PAGE 319.
FIG. 5. POLYMORPHINA OBLONGA D'ORBIGNY. SEE PAGE 319.
FIG. 6. POLYMORPHINA COMMUNIS D'ORBIGNY. SEE PAGE 319.

FIG. 1. UVIGERINA TENUISTRIATA REUSS. SEE PAGE 320.
FIG. 2. UVIGERINA PYGMÆA D'ORBIGNY. SEE PAGE 320.
FIG. 3. UVIGERINA ANGULOSA WILLIAMSON. SEE PAGE 320.
FIG. 4. UVIGERINA ASPERULA CZJZEK. SEE PAGE 320.
FIG. 5. UVIGERINA ASPERULA CZJZEK, VAR. AMPULLACEA BRADY. SEE PAGE 320.
FIG. 6. RAMULINA GLOBULIFERA BRADY. SEE PAGE 321.
FIG. 7. RAMULINA PROTEIFORMIS NEW SPECIES. SEE PAGE 321.

FIG. 1. ORBULINA UNIVERSA D'ORBIGNY. SEE PAGE 323.

a. Accidental Section

FIG. 2. GLOBIGERINA BULLOIDES D'ORBIGNY. SEE PAGE 321.

FIG. 3. GLOBIGERINA INFLATA D'ORBIGNY. SEE PAGE 322.

FIG. 4. GLOBIGERINA DUBIA EGGER. SEE PAGE 322

FIG. 5. GLOBIGERINA RUBRA D'ORBIGNY. SEE PAGE 322.

FIG. 6. GLOBIGERINA CONGLOBATA BRADY. SEE PAGE 322.

FIG. 1. GLOBIGERINA SACCULIFERA BRADY. SEE PAGE 322.

FIG. 2. GLOBIGERINA DIGITATA BRADY. SEE PAGE 323.

FIG. 3. GLOBIGERINA ÆQUILATERALIS BRADY. SEE PAGE 323.

FIG. 4. HASTIGERINA PELAGICA D'ORBIGNY. SEE PAGE 324.

FIG. 5. PULLENIA QUINQUELOBA REUSS. SEE PAGE 324.

FIG. 6. PULLENIA OBLIQUILOCULATA PARKER & JONES. SEE PAGE 324.

FIG. 1. SPHÆROIDINA BULLOIDES D'ORBIGNY. SEE PAGE 325.
FIG. 2. SPHÆROIDINA DEHISCENS PARKER & JONES. SEE PAGE 325.
FIG. 3. CANDEINA NITIDA D'ORBIGNY. SEE PAGE 325.
FIG. 4. SPIRILLINA VIVIPARA EHRENBERG. SEE PAGE 326.
FIG. 5. SPIRILLINA LIMBATA BRADY. SEE PAGE 326.
FIG. 6. SPIRILLINA OBCONICA BRADY. SEE PAGE 326.

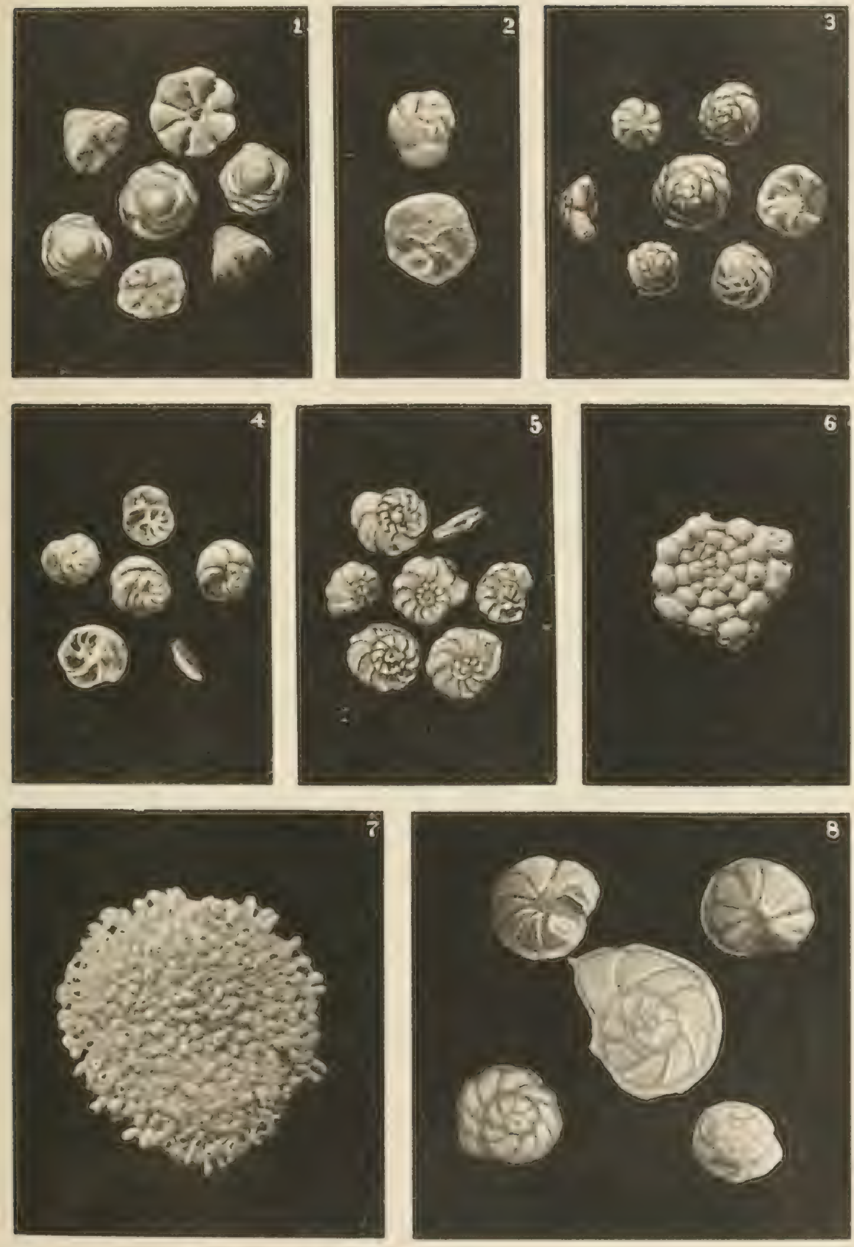


FIG. 1. CYMBALOPORA POEYI D'ORBIGNY. SEE PAGE 326.
FIG. 2. DISCORBINA GLOBULARIS KARRER. SEE PAGE 327.
FIG. 3. DISCORBINA ROSACEA D'ORBIGNY. SEE PAGE 327.
FIG. 4. DISCORBINA BERTHELOTI D'ORBIGNY. SEE PAGE 327.
FIG. 5. DISCORBINA BICONCAVA JONES & PARKER. SEE PAGE 327.
FIG. 6. PLANORBULINA MEDITERRANENSIS D'ORBIGNY. SEE PAGE 328.
FIG. 7. PLANORBULINA ACERVALIS BRADY. SEE PAGE 328.
FIG. 8. PULVINULINA REPANDA FICHTEL & MOLL. SEE PAGE 328.

FIG. 1. PULVINULINA PUNCTULATA D'ORBIGNY. SEE PAGE 328.

FIG. 2. PULVINULINA AURICULA FICHTEL & MOLL. SEE PAGE 329.

FIG. 3. PULVINULINA MENARDII D'ORBIGNY. SEE PAGE 329.

FIG. 4. PULVINULINA MENARDII D'ORBIGNY, VAR. FIMBRIATA BRADY. SEE PAGE 329.

FIG. 5. PULVINULINA TUMIDA BRADY. SEE PAGE 329.

FIG. 1. PULVINULINA CRASSA D'ORBIGNY. SEE PAGE 329.

a. Transverse Section.

FIG. 2. PULVINULINA MICHELIANA D'ORBIGNY. SEE PAGE 330.

a. Partial Section.

FIG. 3. PULVINULINA PAUPERATA PARKER & JONES. SEE PAGE 330.

FIG. 4. PULVINULINA UMBONATA REUSS. SEE PAGE 330.

FIG. 5. PULVINULINA KARSTENI REUSS. SEE PAGE 330.

FIG. 1. PULVINULINA ELEGANS D'ORBIGNY. SEE PAGE 331.
FIG. 2. ROTALIA BECCARII LINNÆUS. SEE PAGE 331.
FIG. 3. PULVINULINA PARTSCHIANA D'ORBIGNY. SEE PAGE 331.
FIG. 4. ROTALIA SOLDANII D'ORBIGNY. SEE PAGE 332.
FIG. 5. ROTALIA ORBICULARIS D'ORBIGNY. SEE PAGE 331.

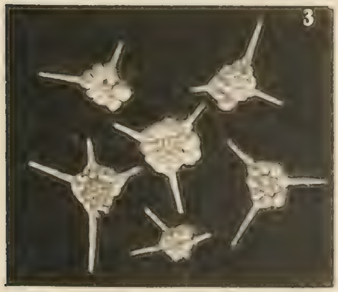


FIG. 1. ROTALIA SCHROETERIANA PARKER & JONES. SEE PAGE 332.

a. Horizontal Section

FIG. 2. ROTALIA PAPILLOSA D'ORBIGNY. SEE PAGE 332.

FIG. 3. ROTALIA PULCHELLA D'ORBIGNY. SEE PAGE 332.

FIG. 4. TRUNCATULINA LOBATULA WALKER & JACOB. SEE PAGE 333.

FIG. 1. TRUNCATULINA WUELLERSTORFI SCHWAGER. SEE PAGE 333.

FIG. 2. TRUNCATULINA UNGERIANA D'ORBIGNY. SEE PAGE 333.

FIG. 3. TRUNCATULINA ROBERTSONIANA BRADY. SEE PAGE 333.

FIG. 4. TRUNCATULINA TENERA BRADY. SEE PAGE 334.

FIG. 5. TRUNCATULINA AKNERIANA D'ORBIGNY. SEE PAGE 333.

a. Horizontal Section

FIG. 6. TRUNCATULINA PYGMÆA HANTKEN. SEE PAGE 334.

FIG. 1. TRUNCATULINA PRÆCINCTA KARRER. SEE PAGE 334.
FIG. 2. TRUNCATULINA ROSEA D'ORBIGNY. SEE PAGE 334.
FIG. 3. TRUNCATULINA RETICULATA CZJZEK. SEE PAGE 334.
FIG. 4. ANOMALINA AMMONOIDES REUSS. SEE PAGE 335.
a. Horizontal Section
FIG. 5. ANOMALINA GROSSERUGOSA GÜMBEL. SEE PAGE 335.

FIG. 1. ANOMALINA ARIMINENSIS D'ORBIGNY. SEE PAGE 335.
FIG. 2. ANOMALINA CORONATA PARKER & JONES. SEE PAGE 335.
FIG. 3. ANOMALINA POLYMORPHA COSTA. SEE PAGE 336.
FIG. 4. RUPERTIA STABILIS WALLICH. SEE PAGE 336.
FIG. 5. NONIONINA BOUEANA D'ORBIGNY. SEE PAGE 337.
FIG. 6. GYPSINA INHAERENS SCHULTZE. SEE PAGE 336.

FIG. 1. NONIONINA SCAPHA FICHTEL & MOLL. SEE PAGE 337.
FIG. 2. POLYSTOMELLA STRIATOPUNCTATA FICHTEL & MOLL. SEE PAGE 337.
FIG. 3. POLYSTOMELLA CRISPA LINNÆUS. SEE PAGE 338.
FIG. 4. AMPHISTEGINA LESSONII D'ORBIGNY. SEE PAGE 338.

a. Horizontal Section. *b.* Perpendicular Section.

PIPES AND SMOKING CUSTOMS OF THE AMERICAN ABORIGINES, BASED ON MATERIAL IN THE U. S. NATIONAL MUSEUM.

BY

JOSEPH D. McGUIRE,

Ellicott City, Maryland.

LIST OF ILLUSTRATIONS.

FRONTISPIECE.

TEXT FIGURES.

NOTE.

The first studies for the following paper on "Pipes and Smoking Customs of the American Aborigines" were made from the rich collections in the U. S. National Museum, but as the material grew it was suggested by Dr. G. Brown Goode, assistant secretary of the Smithsonian Institution, that it would be well to carefully consider the pipes contained in other public museums and in private collections. Acting on this suggestion, an extensive correspondence ensued with many persons interested in the subject, and, as will be observed, the work has been greatly facilitated by their courteous assistance. The writer now desires to express his grateful acknowledgments and thanks for the aid afforded him by the loan of specimens, and when this was not possible, of tracings and photographs; also for the list of references suggested, and for the freedom allowed in examination of pipes on all occasions, and in data concerning localities and circumstances under which certain objects were found.

Among those persons whom the writer desires particularly to mention are Drs. William H. Holmes, Otis T. Mason, Thomas Wilson, and Walter Hough, of the U. S. National Museum; Maj. J. W. Powell, Mr. W J McGee, Dr. J. Walter Fewkes, Mr. F. W. Hodge, and Mr. James Mooney, of the Bureau of American Ethnology; Dr. E. A. Barber and Mr. Clarence B. Moore, of Philadelphia, Pennsylvania; Mr. Stewart Culin and Dr. Max Uhle, of the museum of the University of Pennsylvania; Mr. Andrew E. Douglass, of New York; Mr. David Boyle, of Toronto, Canada; Rev. W. M. Beauchamp, of Baldwinsville, New York; Col. Bennett H. Young, of Louisville, Kentucky; Gen. A. L. Pridemore, of Lee County, Virginia; Prof. John Robinson, of Salem, Massachusetts; Mr. Warren K. Moorehead, of the Ohio State University; Capt. H. L. Scott, of the U. S. Army, and Miss Alice Fletcher, of the Peabody Museum of American Archaeology and Ethnology, Cambridge, Massachusetts. Also my sincere thanks are due to Prof. P. H. Uhler and Col. William H. Love, of Baltimore, Maryland, and Dr. Frank H. Knowlton and Mr. Charles Schuchert, of Washington, D. C., though it should not be supposed that these kind friends are in anywise responsible for any expressions employed in the body of the monograph unless so quoted.

JOSEPH D. MCGUIRE.

ELLICOTT CITY, MARYLAND, *November 21, 1898.*

A SMOKING FUNCTION.

A bas-relief of part of an altar at Palenque.

After Edward S. Holden in First Annual Report of the Bureau of Ethnology, p. 234, fig. 59.

PIPES AND SMOKING CUSTOMS OF THE AMERICAN ABORIGINES, BASED ON MATERIAL IN THE U. S. NATIONAL MUSEUM

By Joseph D. McGuire,

Ellicott City, Maryland.

MEXICAN AND PUEBLO TUBULAR PIPES.

The use of the tobacco plant for smoking purposes is undoubtedly of American origin, and has been common throughout North America among the Indians from a period long prior to the arrival of the whites on the continent. Using the plant for snuffing, however, appears to have been a peculiarity of the Southern Continent, while of the habit of chewing there seems to be but meager reference by early writers, consequently little is known of the extent to which the practice prevailed. The accounts of all early American voyagers, with scarcely an exception, who have come in first contact with the Indians have referred to the common employment of tobacco in all treaties, councils, and, in fact, functions of every kind, including social intercourse, in divination, and in the cure of disease. Other plants, however, have been used quite commonly for the same purpose from the Gulf of Mexico to the Arctic Ocean, and from the Atlantic to the Pacific. There is no doubt that tobacco smoking in pipes such as we are now familiar with, as a habit or pastime, is an invention of the European. Smoke in some form has been employed in the treatment of disease from a time long prior to the Christian era; and the early Spanish, French, and English references to smoking all bear evidence that tobacco was considered a plant of wonderful properties. Herodotus says the Messagetae, a people of Asia Minor, supposed to be Scythians, in battle with whom Cyrus was killed about 529 B. C., are reported "to have discovered trees that produce fruit of a peculiar kind, which the inhabitants, when they meet together in companies and have lit a fire, throw on a fire, as they sit in a circle; and that by inhaling the fumes of the burning fruit that has been thrown on, they become intoxicated by the odor just as the Greeks do by wine; and that the more fruit that is thrown on, the more intoxicated they become, until they rise up to dance and betake themselves to singing."[1]

[1] Herodotus, Book I, p. 88, translated by Henry Cary, New York, 1855.

Many of the early American peoples, including the Aztecs, are described as inhaling smoke for the purpose of intoxicating themselves—a practice yet indulged in at various places. Herodotus also says "that when a man attains great age all his kinsmen meet and sacrifice him," and "that they worship the sun of all the gods." [1]

These rites of the Messagetae are similar to the practices of certain American Indians. That similar conditions naturally engender like practices among races in a primitive stage of development has been observed all over the world. This is noticeable in the primitive tools of all ancient races, there being scarcely an exception to the rule. According to Strabo, the Mysians were eaters of smoke—"Krapnobates." [2]

This reference, however, is rather a suggestion found in a note of the French translation of Strabo than of Strabo himself, who really says "Posidonius relates that the Mysians religiously abstain from eating anything that had life, and consequently from cattle, wherefore they are considered a religious people and called Capnobatae." [3] Plutarch says in De Fluvius, "in Thrace near the Hebrus there grows a plant which resembles the origanum [wild marjoram]; the inhabitants of that country throw the leaves on a brazier and inhale the smoke, which intoxicates them."

Pliny says, "Sandarach, taken in the form of a fumigation, also with cedar, has a remedial effect." [4] This plant is a medium-sized tree (*Callitris quadrivalvis* or *Thuya articulata*) of the pine family from North Africa, and yields a resinous gum, which, when heated or sprinkled on burning coals, emits an agreeable balsamic odor and calls to mind the liquid amber used as a mixture with tobacco by the Aztecs. The Aztecs were described as burning incense and liquid amber and mixing sweet-smelling substances with burning herbs quite often when reference to what we now denominate "smoking" was intended. Reference to the cedar being used in fumigation calls to mind that its bark is smoked at the present time by certain American tribes.

Pliny further says that Appolodorus (a naturalist of the first century) mentions as a remarkable fact that the barbarians, "by inhaling the fumes of chameleuce [colts foot] at the mouth thereby diminish the volume of the spleen." [5] The term "inhalation" suggests something more than a "fumigation," especially when the further recommendation is made of employing the smoke of "dried cow dung" as being remarkably good for phthisis when inhaled through a reed," and "that chameleuce, having its root burnt upon cypress charcoal, the smoke of which is good when inhaled by the aid of a funnel or reed." [7]

[1] Herodotus, Book I, p. 93, translated by Henry Cary, New York, 1853.

[2] Strabo, Book VII, p. 3.

[3] The Geography of Strabo, Book VII, Chap. 3, p. 151, Bohn edition, London, 1854.

[4] The Natural History of Pliny, Book VI, p. 220, Bohn edition, London, 1866.

[5] Idem, Book IV, p. 362.

[6] Idem, Book V, p. 356.

[7] Idem, Book V, pp. 55, 164.

There is little room to doubt that the tube or funnel is an implement of great antiquity in smoking elsewhere than on the American continent. Implements figured as Roman pipes, so far as they have come under the writer's observation, appear to be modern and of the English or French "trade" type. Other plants are so commonly used in the pipe by the Indians of the whole continent and have been so employed, according to early writers, for so long a period as to indicate a very ancient usage. Although there are several native varieties of the family *Nicotiana* in America, it appears highly probable that the use of tobacco first became general through its cultivation by the Spanish and their trade in it with the natives. The Spanish early cultivated it, for next to food they would naturally grow those plants for which there was the greatest demand and the best market among the natives. It is a well-known fact that the English settlers in Virginia during the first half of the seventeenth century more than once brought themselves to the verge of starvation because of their having cultivated tobacco to the exclusion of necessary vegetables.

Throughout the seventeenth century, if not later, smoking was indulged in by Europeans mainly because of the wonderful properties attributed to tobacco. It was supposed not only to cure disease, but was considered a detergent as well. It was said to prevent the pangs of hunger and fatigue, and was long prescribed as a medicine by the physicians of Spain, France, and England. The visitation of the plague in Europe encouraged the use of tobacco enormously, as it was supposed that it would keep off the disease; and was so sought after and so generally prescribed that its use quickly became a confirmed habit among many persons, and the use of that which had been looked upon as a valued medicine became perverted into a vice difficult to eradicate. And as late as the time of Charles II, tobacco was supposed to be a mighty antidote to the plague, and it has been said that at a certain time during his reign the worst floggings the boys ever received at Eaton were because they refused to smoke.

The employment of the words "funnel" and "reed" by Pliny may appear to be indefinite references to the pipe, but they are equally as distinct as are many of the early Spanish, French, and English expressions used in regard to it, even as late as the first half of the seventeenth century, at which date the word "tobacco" had not yet come into general use.

The most ancient, and at the same time the most reliable evidence of the early employment of the pipe on the American continent is the bas-relief of the Alta Casa or Adoratio, at the entrance of the temple of the Cross, one of the so-called palaces of Palenque, to which attention was called by John L. Stevens, it being deservedly considered one of the most remarkable as well as one of the best known of American antiquities.[1] It is shown as the frontispiece.

[1] Travels in Central America and Yucatan, II, p. 354, New York, 1848.

This slab, or altar, as it has been called, is of artistic concept, design, and finish; it has been referred to as representing a "Maya rain god, Tlaloc, blowing the winds from his mouth." He is figured "with the eagle in his headdress; the jaw with grinders; the peculiar eye; the snake between his legs, and a leopard skin over his back." This glyph represents the official, whether priest or other functionary, standing in an upright position, his arms extended, with the palms of the hands held together, forming a trough at a level with the mouth; lying in this trough of the hands is a tubular object, through which he appears to be blowing a visible something, as indicated by the ascending and descending part of the glyph. The posture is such as may be seen to-day when the Moki priest thus holds the pipe at a ceremonial dance and blows the smoke to the four winds, as well as to the upper and the lower world. The implement upon the slab has the exact shape of the ceremonial pipe of the Moki, as represented by Dr. J. Walter Fewkes. This, moreover, appears to be the type of the most primitive pipe found in America, and the one which is distributed over a greater geographical area than any other found on the continent, and is, in fact, the only type which appears common to the whole country. This opinion is sustained by the pipes found by archæologic excavations in many States, which suggest the tube similar in shape to that pictured on the Palenque tablet as the most primitive pipe of which we have knowledge. "The leopard skin on the back, the beak and eyes of the bird on the headdress of Tlaloc," says Stevens, "was all a mystery, silent, defying the most scrutinizing gaze and reach of the intellect."

The snake so prominent on this slab appears as a garment of snakes on the statue of the bloody Huitzilopotchli, the war god of the Mexicans, who is represented as holding in each of his claw-like hands a human heart. To find a snake carved upon the pipe is by no means an unusual feature, it being one of the most common totems of the North American Indian tribes. The bird, either a hawk or an eagle, on the Palenque tablet represents, very likely, one of the totems. Palenque is in the State of Chiapas, Mexico, in latitude 17° 30′ north, longitude 92° 26′ west, and is supposed to have been in ruins before the invasion of Mexico by Cortez. The smoker, if such he be, on the slab, invests it with unusual interest, for in addition to its being of pre-Columbian origin, its location appears to be that of the extreme southern limit of the pipe in America, so far as we know from records or reliable antiquities.

While the writer is convinced that the tube is the primitive form of the pipe both in Palenque and in the City of Mexico, pipes have been found having their bowl at right angles to the stem. The latter, however, are made from a glazed, red or gray pottery which there is reason to suspect are of Spanish origin and manufacture. While early Spanish writers refer but casually to the habit of smoking among the natives, they constantly speak of the use of incense, and there is reason to

believe that the use of the pipe was often indicated by this expression. It must be remembered that smoking, by its general adoption among the people, struck all early voyagers to America with astonishment, though Spanish, French, English, and Dutch each in turn found wonderful properties in the use of this "sacred herb," or, as Everard calls it, "Embassadors' herb."[1]

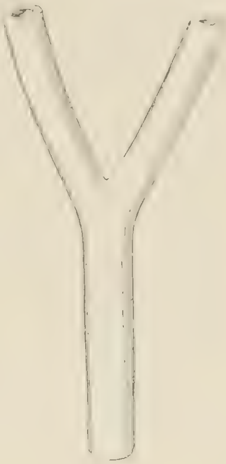


Fig. 1.
A TOBACCO PIPE.
Referred to by Oviedo.

Fig. 1 is an enlargement, after Oviedo, of what is commonly referred to as the first illustration of the American tobacco pipe, though the first two editions of the work did not contain it. The figure was evidently drawn from a description of an instrument which is said to have been used as a snuffing tube employed in inhaling a preparation of the powder, *parica*. This article, Oviedo says, was called a "tobago" and it was evidently that which gave its name "tobacco" to the plant. The only object of this character which has come under the observation of the writer is a very perfect specimen in the museum of the University of Pennsylvania, which is made from the femur of a llama, and is 5 inches long, with a width of 1½ inches at the extremity of the bifurcation, the widest part of the bone. This tube (fig. 2) is carefully polished, and decorated on each side with geometric figures, the significance of which are indecipherable, though the circles upon the bifurcated end look as though intended to represent eyes. The figures are incised and most skillfully executed with some sharp implement. It was found at Tiahuanaco, Bolivia.

Fig. 2.
SNUFFING TUBE.
Tiahuanaco.
After Dr. Max Uhle, University of Pennsylvania. Original in University of Pennsylvania.

The remarkable similarity of certain smoking customs in the most widely separated parts of the continent is the strongest argument in favor of the antiquity of the habit, and there is little doubt that the smoking of some plant in pipes or tubes has prevailed very generally from a time long prior to the coming of the Europeans on the continent of North America. The most primitive pipe of all was a straight tube, many of which have been found in aboriginal burial places, from Mexico to the Great Lakes, and from the Atlantic to the Pacific oceans. The tube varies, it is true, in both length and diameter, as well as in the material from which it is made; governed,

[1] Everard, Panacea, or the Universal Medicine, p. 4, London, 1659.

doubtless, by the available supply. The first materials employed would be reeds, hollow bones, or wood, which, through a process of evolution, came in time eventually to be stone or earthenware. There is undoubted evidence that pipes throughout the continent were made in many shapes, though it is probable that the most elaborate are the most modern. An endless variety of leaves, twigs, bark, and even the roots of plants have been smoked by American Indians, though sumac and willow have been used by them to nearly as great an extent as tobacco. At times other plants are smoked in preference to tobacco, or as a prerequisite of some ceremonial dance or function.

Excepting the tubular form, the shapes of early American pipes differ greatly with the locality where they occur; those in contiguous territory usually being similar. The geographical limits of a particular pipe, with scarcely an exception, follow the lines of natural trade routes and water courses, which are also, it is true, the lines of least resistance in the distribution of population, because of the greater facility of transportation.

Notwithstanding the ancient foreign references to a habit apparently quite analogous to the use of the tobacco pipe by the American savages, Europeans do not appear to have smoked the pipe until tobacco was carried abroad from America, for all early travelers to this continent appear to have been astonished at the, to them, singular custom of smoking, and they were convinced that the tobacco plant was possessed of wonderful properties, and but few of them failed to refer to it with surprise when they first came in contact with the natives of the Northern Continent.

Columbus on his first voyage mentions the people of Hispaniola as smoking, though the reference appears to relate to something in the nature of a cigar or cigarette rather than a tobacco pipe. Beginning with the dawn of man's employment of tools, throughout all primitive periods of history, and from the most distant parts of the earth's surface, similar customs and implements are encountered which are impossible of reconciliation one with another unless it be that similar conditions produce like results. Among these the inhalation of smoke is only one of many which might be enumerated.

Tobacco was indigenous to the new continent, and the first reference to its use, though not by name, was that reported to Columbus on his first voyage by Rodrigo de Jerez of Agramonte and Luis de Torres, a learned Jew, who were sent out in Hispaniola on November 2, 1492, with letters to the Kahn of Cathay. De Torres could speak Chaldee, Hebrew, and some Arabic, and was thought to be a valuable interpreter for those subjects of the Grand Kahn whom Columbus should encounter.[1]

These messengers, as referred to by the Marquis of Nadaillac, quoting Columbus, "found a great number of Indians, men and women,

[1] Arthur Helps, The Spanish Conquest in America, I, p. 124, New York, 1856.

holding in their hands little lighted brands made of herbs, of which they inhaled according to their custom."[1] According to other writers they were said to have indulged in "a fumigation of a peculiar kind."

The smoke in question was absorbed into the mouth through a charred stick, and was caused by burning certain herbs wrapped in a dry leaf, which outer covering was called "tabaco."[2]

These messengers, says John Harris, "lighting of an Indian town of fifty houses, they were well treated there, the Spanish being honored as if they had been deities."[3] Quite as indefinite is the expression "incensing," later employed on the mainland upon numerous occasions in the various accounts of Cortez's march to the City of Mexico, or as "perfuming themselves." Las Casas, who was a contemporary of Columbus, and the first bishop of Chiapas, is quoted as saying that the "two messengers met great numbers of people of both sexes, the men always with a firebrand in their hands and certain herbs for smoking. These were dry, and placed in a dry leaf, after the manner of those paper tubes which the boys in Spain use at Whitsuntide. Lighting one end, they drew the smoke by sucking at the other. This causes drowsiness and a kind of intoxication, and, according to the statement of natives, relieves them from the feeling of fatigue. These tubes they call by the name of *Tobacos*."[4]

In the early references to smoking a notable peculiarity is that the term employed very commonly is "herbs," which may be because of ignorance of the plant smoked, though it is certainly suggestive also of there being more than one, for it is known that certain of our Indians consider it an essential to their ceremonial smokes or dances to have a mixture of different plants to put in the pipe; though when smoking for the purpose of becoming stupefied or intoxicated tobacco is used. The "firebrand" mentioned by Las Casas was "a kind of musquetoon packed of a dry leaf, which the Indians lit at one end while they sucked it or inhaled it from the other. These musquetoons were called Tabacos."[5]

Nadaillac says it is here easy to recognize the cigar of the present day, "of which the shape has had but slight modifications." The same could with equal accuracy be said of the cigarette. Cigars and cigarettes appear so common in all Spanish America as to cause a strong presumption that one or other was intended, though the early references are invariably indefinite.

Las Casas, according to Helps, states that the Indians when questioned about imbibing tobacco smoke said that it took away fatigue,

[1] Marquis de Nadaillac, Les Pipes et le Tabac; Matériaux pour l'Histoire Primitive et Naturelle de l'Homme, 1885, p. 498.

[2] Arthur Helps, The Spanish Conquest in America, I, p. 125.

[3] John Harris, Columbus's First Voyage, Voyages and Travels, I, p. 5, London, 1705.

[4] Arthur James Weise, Discoveries of America to the year 1525, p. 120, New York and London, 1884.

[5] Les Pipes et le Tabac; Materiaux, etc., 1885, p. 498.

and that he has known Spaniards in the island of Hispaniola who adopted the same habit, and who, being reproved for it as a vice, replied that it was not in their power to leave it off. "I do not know," he adds, "what savor or profit they found in them (tobacos)."[1]

Millions of people throughout the world still sympathize with this sentiment. The habit has increased until it has encircled the earth, and to-day there is scarcely a race which has not adopted the pipe in some form, though not always confining themselves to tobacco. Opium is a rival to it in some parts of the East, and hasheesh (*Cannabis sativa*), an East Indian hemp, is smoked in India for its intoxicating properties. Some idea may be gained of the consumption of tobacco from the production of the manufactured article in the United States in 1897, which for smoking tobacco, cigars, and cigarettes amounted to the enormous sum of 371,705,148 pounds. How many of those who consume this tobacco ever consider "what profit they found in it?" There are many, who agree with Benzoni, of Milan, who, about 1541, said, "See what a pestiferous and wicked poison from the devil this must be. It has happened several times to me that going through the provinces of Guatemala and Nicaragua I have entered the house of an Indian who had taken this herb, which in the Mexican language is called tobacco, and, immediately perceiving this sharp, fetid smell, I was obliged to go away in haste and seek some other place. In La Espana and other islands when their doctors wanted to cure a sick man they went to the place where they were to administer the smoke, and when the patient was thoroughly intoxicated by it the cure was mostly effected."[2]

To many smoking is only a habit admittedly without profit; to others it is a "pestiferous weed;" to others again smoking is a solace and unfailing comforter in solitude or sickness; to its votaries it is often a nerve tonic of priceless value in times of great mental excitement, and a sedative in favor of which too much can scarcely be said.

Speaking of the messengers of Columbus who first witnessed smoking, it is interesting to note the opinion of Washington Irving, who speaks of tobacco as a weed which "the ingenious caprice of man has converted into a luxury in defiance of the opposition of the senses."[3]

Bernal Diaz, who was first with Juan de Grijalva, in 1518, on the coast of the mainland of the continent, and who appears also to have been, in 1517, with Francisco Hernandez de Cordova in his expedition, accompanied Cortez throughout his wonderful march to the City of Mexico. Of his early history little appears known, though it is supposed he was a foot soldier. The historian of the conquest, and thoroughly familiar with the daily events of the period, he wrote about

[1] The Spanish Conquest in America, New York, 1856, I, p. 125, referring to Historia de las Indias, MS., Book I, Chap. 40.

[2] Gerolamo Benzoni, History of the New World, 1541–1556, pp. 80, 81, 82 (Hakluyt Society).

[3] The Life and Voyages of Christopher Columbus, p. 129, referring to Navarette, Primer Viage de Colon, p. 51.

1568, and in the light of contemporary accounts there is little doubt that many of his references to the natives using "perfumes" and "incense" related to the practice of smoking tobacco or other plants. It is not intended to deny that incense or perfume was used in the temples of Mexico or among the natives upon occasion, but it is contended that these terms, where used by the Spanish historians, referred generally to what we now describe as smoking, rather than to what is understood by the term perfuming or incensing. Upon several occasions where these words are employed contemporaneous writers are so clear in their references to tobacco smoking as to leave little room for doubt. Spanish descriptions can be better appreciated when it is remembered that the practices referred to were novel to the writers, and the only thing to which they could liken it was the incense of the church, with which they were all familiar. The Spanish references to the smoking of tobacco are apparently confined to its employment by the great "lords" after their dinners, though many of them point to the use of tobacco in conjunction with other things, such as liquid amber, etc.

It must not be forgotten that ceremony and the ceremonial observance of all serious events in life occupied a great part of the Mexicans' time, and the same was the case with the aborigines to the north of Mexico. It will be shown that tobacco was later the plant almost invariably smoked at solemn and ceremonial councils with the whites throughout the continent. In Mexico and to the northward for an indefinite distance there appears always to have been a mixture of herbs used in local ceremonies, as is yet the case in some of the Pueblo dances, especially those of Moki. Juan de Grijalva, the discoverer of Mexico, who died in 1527, according to Diaz, embraced the natives "in token of peace, gave them strings of beads, and as it is customary to make amicable presents in amicable treaties, they [the natives] came with fish, fowl, and vessels with lighted coals to fumigate us with incense;" and at what is now St. Juan de Ulloa, he says, "upon our entering [the temple] they came to us with their pots of incense, but we could not endure it, being disgusted and grieved at the sight and the horrid cruelty of their sacrifices."[1]

The ingredients of this "incense," if Clavigero be correct, were not such as to recommend it to the favor of Europeans, and fortunately do not appear to have survived to our time. He says: "The priests took large quantities of poisonous insects, such as scorpions, spiders, and worms, and sometimes even small serpents, burned them over the stove of the temple, and beat their ashes into a mortar together with the soot of the ocotl [a species of very aromatic pine], tobacco, the herb ololimbqui, and some live insects."[2]

That this offering was identical with that of the pipe, so common on the northern continent at the end of the last century, is shown by the

[1] Diaz, True History of the Conquest of Mexico, pp. 17, 20, London, 1800.

[2] Clavigero, History of Mexico, II, p. 44, Philadelphia, 1817.

same writer, who says: "These offerings of incense were made also by the women to the idols, which was not confined to an act of religion to their gods, but also a piece of civil courtesy to lords and ambassadors."[1]

Diaz says that upon a certain occasion in the island of Cozumel (1519), the Spaniards having been attracted to a certain temple, "the Indians were found burning odoriferous resins like an incense,"[2] and later he states that the Mexicans sent their "ambassadors with vessels of incense which they offered us and with which they fumigated Cortez."[3] This function is repeatedly referred to during the march, as occurring with the Tlascalans, the Cholulans, and at the city of Quivistlan, nor was it confined to offerings to Cortez, but to whoever was the leader at the particular time. We encounter the same ceremony offered at Villa Rica to Escalante, who was there "fumigated." The most casual consideration of this practice shows so great an analogy between these "incense burnings" and "fumigations" (especially as tobacco is mentioned among the ingredients composing it), and the calumet dances and offerings to leaders, not only of the French on the Mississippi and the Great Lakes, but also to the English along the Eastern seaboard, as to amount to conviction that the offerings in many cases was of the pipe.[4]

Four days after the arrival of the army in the City of Mexico Cortez and Montezuma visited the temple and witnessed the offering of incense to the war gods,[5] and it is yet observable at Moki in the dances, where they invariably offer smoke to their idols, the ceremonies of the pipe being observed by all present with great solemnity and decorum. The head chief is attended by an assistant of nearly like rank, who ceremoniously lights the pipe, and with a certain form and set words hands it to the chief, who blows the smoke of the pipe to the world quarters and over the altar.

At times offerings were made by "those who happened to be in danger from stumbling or slipping or on a journey." Incense offerings, Clavigero says, "were made four times a day—at daybreak, midday, sunset, and midnight. They used copal [*Bursera*] or some other aromatic gum, and on certain festivals employed chapopotli or bitumen of Judea,[6] which was also used by the women to clean their teeth with." Similar practices are noted later on the Mississippi among the Natchez, whose offerings were made to the sun, and the Indians of Virginia, a century afterwards, were said to make offerings of tobacco in setting out on a journey.

The censers of the Mexicans were commonly made of clay, but they

[1] Clavigero, History of Mexico, II, pp. 46, 58, Philadelphia, 1817.

[2] Diaz, True History of the Conquest of Mexico, p. 36, London, 1800.

[3] Idem, pp. 49, 57.

[4] Idem, pp. 69, 86, 105, 109, 118.

[5] Idem, p. 143.

[6] Clavigero, History of Mexico, II, pp. 27, 43, 44, Philadelphia, 1817.

also had them of gold, and no house was without them nor wanted idols.[1]

These censers or pipes and idols or fetiches appear to the writer the same things under different names, the variance being due to difference in time and to the nationality of those describing the one and the other. Clavigero on one occasion refers to ambassadors making their offerings "by touching the earth with their hands,"[2] which Antonio de Solis describes minutely in his reference to the ambassadors from Tlascala, "who every now and then stopped and made signs of respect with humility toward the quarters, bowing their bodies till they touched the ground with their hands; then, raising themselves and putting them to their lips, paid greater respect with the smoke of their censers."[3]

This is a similar exhibition to that spoken of when Cortez made peace with the Cacique of Tabasco, after first repulsing an embassy of an inferior quality of persons who returned in numbers with their ornaments, and, having approached with great submission, they perfumed him "with their fire pans, in which they burned gum anime (a white resin), gum copal, and other sweet scents."[4]

These savages "in their festival given in honor of their war god, Huitzilopochtli, were, by permission of Alvarado, allowed to come unarmed, and having done so, were set upon by his orders and not an Aztec was left alive."[5]

These natives were idolatrous and low among the races of men, according to the belief of the period, and the punishment of death was considered light for their inherited wickedness; yet some of the Spanish practices are as barbarous as anything noted of the Aztec, especially that of dressing their wounds with the fat of dead Indians, to which Diaz quaintly refers, a practice apparently common at that period, for, according to Biedma, De Soto's soldiers, about 1540, who were wounded "had their wounds dressed with the fat of the slain, because our medicine was burnt with the baggage."[6]

In fig. 3 is again seen a conical object, similar to that on the Palenque tablet, which Prof. Cyrus Thomas takes to be a cigar. Its similarity to the primitive conical pipe is, however, so striking as to impress one with the idea that this figure, wherever encountered, is intended for a pipe. The illustration is taken from The Manuscript Troano, Plate XXI,[7] and is doubly interesting because antedating European contact.

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[1] Diaz, True History of the Conquest of Mexico, I, pp. 44, 261.

[2] History of Mexico, p. 281.

[3] Antonio de Solis, History of the Conquest of Mexico, p. 158, London, 1724.

[4] Idem, I, p. 64.

[5] William H. Prescott, History of the Conquest of Mexico, II, p. 282, Philadelphia, 1860.

[6] B. F. French, Expedition of Hernando de Soto, Historical Collections of Louisiana, p. 103.

[7] Cyrus Thomas, Contribution to North American Ethnology, V, p. 131, fig. 46, U. S. Geographical and Geological Survey.

All early references to smoking are exceedingly indefinite, due to the writers trying to convey to their readers their impressions of something entirely novel, and consequently most difficult to describe for want of something with which to compare it.

It must be admitted that the early references to smoking in America, while showing it to be a common practice among the Mexicans, so far as known to the writer do not suggest the rectangular pipe. All Spanish American people smoke the cigarette or cigar. As early as 1752 it was said of the natives of Carthagena: "Every one smokes, men and women alike, without distinction of age or rank. They *petun* everywhere and on all occasions. The women hold in their mouths a piece of lighted tobacco, from which they draw the smoke for quite a length of time without letting it go out and without the fire inconveniencing them, and one of the greatest acts of friendship which they can evidence to a person is to light the tobacco for them."[1]

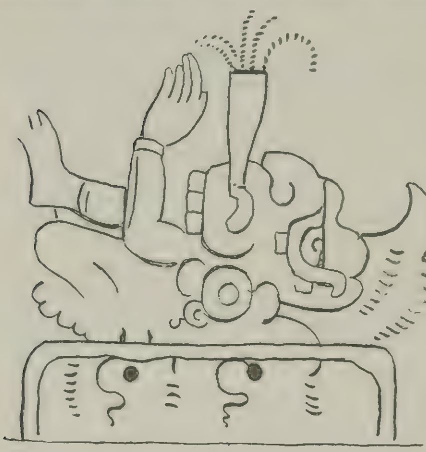

Fig. 3.
MEXICAN SMOKING.
From The Manuscript Troano.

This refers apparently to cigar or cigarette smoking, which was probably the survival of a native custom.

Edward B. Tylor says "the Mexicans were cultivating tobacco when the Spaniards invaded the country, and had done so for ages; it had gotten its name from the language of Haiti, meaning not the tobacco itself but the cigars made of it."[2]

There is no doubt that tobacco was cultivated; but only to a limited extent, prior to the Spanish invasion. As soon as the conquest was accomplished the Spaniards put the natives to work in mining the precious metals and in growing tobacco, for which there was a constant and increasing demand.

De Solis says of Montezuma: "He used to smoke tobacco perfumed with liquid amber [*Liquidambar styraciflua*, or sweet gum], and this vicious habit passed for a medicine with the Indians, which withal had somewhat in it of superstition, for the juice of this herb was one of the ingredients with which the priests were worked up into madness and fury as often as they were obliged to prepare themselves by losing their understanding to receive the devil's oracles."[3]

[1] Antonio de Ulloa, Voyage Historique de l'Amerique Meridionale, Book I, p. 35, Amsterdam and Leipsic, 1752.

[2] Anahuac, p. 228, London, 1861.

[3] History of the Conquest of Mexico, Book III, p. 81, London, 1724.

Clavigero, an unusually well-informed writer, who lived among the natives of Mexico for thirty-odd years, about the middle of the last century, referring to the early Mexican practice of smoking, says: "After dining the lords used to compose themselves to sleep with the smoke of tobacco. This plant was greatly in use among the Mexicans. They make various plasters with it, and took it not only in smoke at the mouth, but also in snuff at the nose. In order to smoke it they put the leaves, with the gum of liquid amber and other hot, warm, and odoriferous herbs, into a little pipe of wood or reed, or some other more valuable substance. They receive the smoke by sucking the pipe and shutting the nostrils with the fingers, so that it might pass by the breath more easily toward the lungs. * * * But what ought to excite still greater wonder is that, although the use of tobacco is now so common among those natives who formerly despised it, it is now so rare among its inventors that there are extremely few of the Indians of New Spain who take it in smoke, and none at all who use it in snuff."[1]

The more closely the manners and customs of the Aztecs and other natives of Mexico are studied the greater is found to be the similarity between them and the northern Indians, the real difference being that the Mexican has been described in glowing terms as possessing a well-organized government, whereas the prosaic Indian has been represented and treated very much as a savage, having no good qualities. Dr. J. Walter Fewkes has found among the Moki Indians of New Mexico a cigarette, which answers completely that described as being used by the Mexicans. It is a small reed, not over $2\frac{1}{2}$ inches long, into which they pack tobacco; a band of some fabric is bound around it and sewed into the reed, leaving a flap hanging down by which to hold it. These cigarettes are found in large numbers in the sacrificial caves in the vicinity, and appear to be a survival of one of the most primitive of smoking arrangements. The natives of Mexico are fond of a weed called *Mariguana* (?), for mixing with the tobacco in their cigarettes, which when it is smoked and inhaled by them is said to produce a hilarious spirit in the smoker.[2]

A curious custom is related of the people of Yucatan. The children at a particular period made offerings to certain animals, which in a measure were considered as their sponsors through life. This offering was "made of a certain gum of pleasant smell, called copal, which they burn as an incense upon an altar. These animals were wild beasts, which were supposed to have assumed responsibility for the children who had been exposed in certain localities in their earliest infancy, and were known by the tracks found near them in the morning after a night of exposure."[3]

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[1] Clavigero, History of Mexico, II, p. 263, translated from Italian by Charles Cullen, Philadelphia, 1817.

[2] St. Louis Globe-Democrat, November 18, 1897.

[3] John Harris, History of the Buccaneers of America, Voyages and Travels, II, p. 823, London, 1705.

Prescott says the pipes used by the Mexican were "made of varnished and richly gilt wood, from which he inhaled sometimes through the nose, at others through the mouth, the fumes of an intoxicating weed called tobacco, mingled with liquid amber."[1]

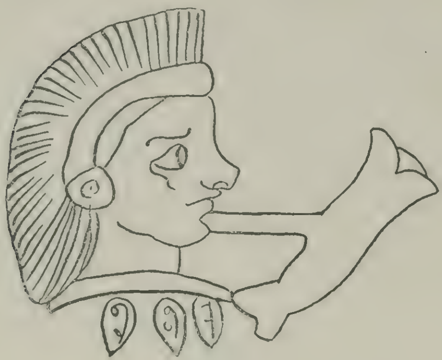

Fig. 4.

MEXICAN SMOKING.

After Kingsborough, Vol. II, p. 84.

Diaz, however, identifies them "as three little canes highly ornamented, containing liquid amber mixed with an herb called tobacco, which when brought" to Montezuma "he took a little of the smoke of one of these canes and then laid himself down to sleep."[2]

Kingsborough illustrates, in his great work on the "Antiquities of Mexico," two figures of persons who appear to be smoking pipes, though in the text he does not refer to them as such. Fig. 4 appears to be a warrior who is dressed in netting with large mesh. He wears a necklace of claws, and in his mouth appears to be a pipe; only the head of the figure is here reproduced. The second person (fig. 5) holds in his hand a pipe, and has in the left hand, apparently, a bouquet; the object in the right hand Kingsborough refers to as a cane. He says these figures are scantily clothed to show their confidence in the field, as they are certain to return with sufficient booty to weigh them down.[3]

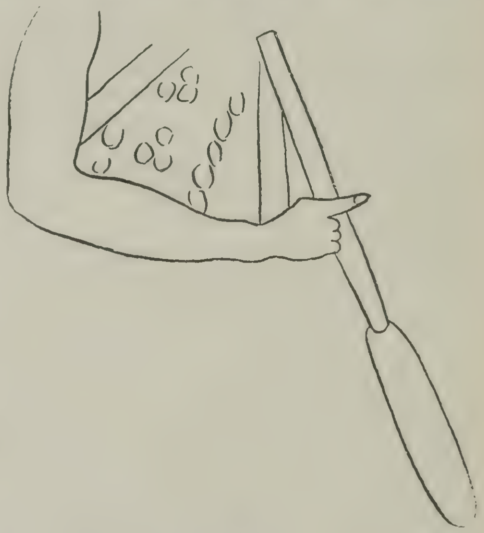

Fig. 5.

MEXICAN HOLDING PIPE.

After Kingsborough, Vol. II, p. 84.

Clavigero speaks of the Mexicans using "pipes or reeds" containing tobacco and liquid amber and "which were beautifully varnished."[4]

According to Bernal Diaz, as quoted by Bancroft, these pipes were painted and gilt.[5]

[1] William H. Prescott, History of the Conquest of Mexico, II, p. 126, Philadelphia, 1860.

[2] True History of the Conquest of Mexico, p. 140, London, 1800.

[3] Antiquities of Mexico, II, p. 84.

[4] History of Mexico, I, p. 283.

[5] Hubert Howe Bancroft, The Native Races of the Pacific States, II, p. 178, San Francisco, 1874.

Diaz also says that sweet canes filled with tobacco and mixed with liquid amber were sold in the city.[1]

Montezuma's sleep differed but little from that of the Indian who slept stupefied from the inhalation of the fumes of tobacco, a practice quite commonly adopted among many of the American Indians, notably those along the Pacific coasts, and whose habits, from geographic location, we would naturally expect to find similar to those of their neighbors, and from whom there is reason to suppose they copied the habit, even if they did not receive it from the Spaniards. Clavigero distinctly implies the similarity of the Mexican habit to what is known to exist north of Mexico. He says "they receive the smoke by sucking the pipe and shutting the nostrils with their fingers, so that it might pass by the breath more easily toward the lungs."[2]

Even as early as 1541-1556 Benzoni, of Milan, tells how slaves brought by the Spaniards "from Ethiopia preserved the leaves of a plant which grows in these new countries which was picked in its season, tied up in bundles, and suspended by them near their fireplaces until very dry: to use them they take a leaf of their grain (maize), and, one of the other plant being put in it, they roll them tight together." He then describes the inhalation of this, which is neither cigar nor cigarette, though having properties of both, and says: "So much do they fill themselves with this cruel smoke, that they loose their reason and fall down as though they were dead, and remain the greater part of the day or night stupefied, though others are content with imbibing this smoke to make them giddy and no more."[3]

Nicolas Monardes, of Seville, was the first, apparently, who spoke of the tobacco plant by its present name. In De Simplicibus Medicamentes, Antwerp, 1574, which is translated into French in Historie des Drogues, Lyons, 1602, by A. Colin, he, as all others have done, discussed its properties along with those of other medicinal plants. He refers to copal and anime, both of which were gums which gave off strong odors when burned, and were also used in the sacrifices in the temples and were held to the noses of the Spaniards when they came to the country, as an incense,[4] and were at times used in connection with tobacco, as were other gums, such as storax, tacamahaca, and liquidamber,[5] the latter of which was obtained by making incisions through the bark of the tree, by which means a resin exuded, and by mixing it with the powdered bark it gave a stronger odor.[6]

The tobacco plant undoubtedly owes its great popularity to the wonderful properties which were early ascribed to it, chief of which Mo-

[1] Hubert Howe Bancroft, The Native Races of the Pacific States, II, p. 144, San Francisco, 1874.

[2] History of Mexico, II, p. 262.

[3] Girolamo Benzoni, History of the New World, p. 80 (Hakluyt Society).

[4] Nicolas Monardes, Histoire des Medicines Simples, p. 104, Lyons, 1602.

[5] Idem, p. 506.

[6] Idem, p. 520.

nardes says, was its curative qualities with wounds. He further says it was first carried to Spain as much for its beauty and ornament in gardens as for its virtues.

"The name tobacco was given to it by the Spanish from the island of the same name, and while only the use of the leaves of the plant is advised, seed was at times utilized when the leaves were not available. These leaves were strung together, hung in the shade and dried, and used whole or powdered, and were considered good for headache, lockjaw, toothache, coughs, asthma, stomach ache, obstructions, kidney troubles, disease of the heart, rheumatism, the poisoning from arrows, carbuncles, polypus, consumption," etc.[1]

The methods of using the plant were almost as numerous as the diseases for which it was considered a cure, a few of which are enumerated as follows: To heat the leaves and apply them to the parts affected; to rub the teeth with a rag dipped in the juice; wrapping a leaf into a pill and inserting it in the tooth; boiling the leaves; decoctions of its leaves; made into a sirup; smoking it by the mouth; reducing the leaves to ashes; pounding the green leaves and mixing them with oil or steeping them in vinegar; if leaves are not to be had, the powder may be used as a poultice; in fomentations; by smoking through the nose; rubbing the leaves on the afflicted parts; inserting the juice into the wound or applying bruised leaves to the wound.

Monardes says: "Tobacco smoke was received by the nose, and in smoking the priests received the smoke through little tubes or canes, and after they tumbled as if in ecstacy. Upon recovering, they related what they had conversed about with the evil spirits, and gave ambiguous replies to their followers. In addition to this, the people take the smoke both by the mouth and by the nose for pleasure when they desire to see the future in their dreams. For just as the devil is an imposter and knows the virtue of herbs, he has posted them on the power of this plant, for by the illusions of their dreams he deceives the people miserably."[2]

"The Indians, tired from carrying their burdens or from other work, inhaled tobacco smoke and fell suddenly as though deprived of reason, and when they recovered found themselves refreshed by their sleep and their strength restored. The Ethiopians, carried to these parts as slaves, wishing to lighten their condition, inhale too much, which causes their masters to chastise them severely, and they burn their tobacco to keep them from using so much, which leaves as a sole alternative to use it in secret. The Indians use tobacco to keep away thirst and hunger, and do it in the following way: They burn certain river shells, then powdering them as fine as chalk, they mix them with an equal quantity of powdered tobacco and chew it until it forms a solid mass; then they make it into pills slightly larger than a pea; then, drying it again,

[1] Girolamo Benzoni, History of the New World, p. 529 (Hakluyt Society).

[2] Nicolas Monardes, Histoire des Drogues, p. 535, Lyons, 1602.

they use it when needed. In making a journey through a desert country, where food and drink are scarce, they put these pills between their lips and teeth and suck the juice, and when one is gone they replace it with another through a journey extending over three or four days, during which time they say they have not been hungry or thirsty."[1]

The inhabitants of Brazil were the first to carry the seed of this plant to Portugal, and called it petum. The French called it herbe la reine, because Jean Nicot, formerly Portuguese ambassador, gave the seed to the Queen Mother and explained to her its virtues and properties. Others called it herbe sainte, because of its great power, and "it appears to me," Monardes says, "to answer very well the description of black henbane."[2]

Monardes evidently refers to cigars and pipes in speaking of tubes proper to be used by asthmatics. He says: "There are brought from New Spain certain tubes of cane, greased inside and outside with a certain gum, which, in my opinion, is nothing else than juice of the tobacco, for it goes to the head. On the side called bitumen they burn the tube, while on the other side they put it in the mouth and smoke by inhaling."[3]

Wafer describes a curious smoking custom among the people of Darien in 1681. "The tobacco leaves," he says, "are rolled up sideways until they make a roll as big as one's wrist and two or three feet in length. A boy lights one end, wetting the part next to it to keep it from wasting too fast. He puts the lighted end in his mouth and blows into the faces of the company, even if there should be two or three hundred, and they hold their breath as long as possible."[4] Though among the Maya people the pipe is not now smoked, and it is doubtful if it ever was.

These authorities are sufficient to establish the fact that the islanders and Mexicans were acquainted, not only with the cigarette but also with the cigar, though the "reed" of the Mexicans approaches more nearly the pipe or tube than either. This reed pipe is noted in 1540 on the lower Colorado by Alarcon, the natives being described as carrying "small reed tubes for making perfumes, as do the Indian tabagos of New Spain,"[5] and if cigarettes are referred to, custom has changed but little, and is still in daily use by the Zuni and Moki of New Mexico. "The doctors cured their patients by blowing on them with thin tubes

[1] Nicolas Monardes, Histoire des Drogues, pp. 537, 538, Lyons, 1602.

[2] Idem, p. 541.

[3] Idem, p. 698.

[4] Lionel Wafer, A New Voyage and Description of the Isthmus of America, p. 102, London, 1699.

[5] Hernando Alarcon, Relation de la Navigation et de la Decouverte, translated by H Ternaux Compans, p. 322, Paris, 1838. Also in Hakluyt's Voyages, III, p. 514, London, 1810, reprint of edition of 1600.

of reed, which were worn on one arm, while little pieces of deer bone used for scraping off the sweat were worn upon the other.[1]

Prescott refers to "pipes of tortoise shell and silver, containing tobacco mixed with aromatic substances, which were offered to the company by the Mexicans, whom, he says, compressed the nostrils while they inhaled the smoke,"[2] showing that its purpose was to stupify the smoker. Dr. Fewkes, excavating during the summer of 1895 at the ruins of Sikyatki, in northeastern Arizona, found several tubes or pipes much resembling cigarette holders, and as the excavations here showed that only a primitive condition existed at the time of the abandonment of the town or pueblo, the presumption is in favor of its antiquity, and may reasonably be considered pre-Columbian. These tubes, which were straight, though the bowl was much larger than the stem, were made both of stone and of pottery.

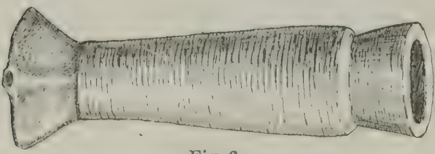

Fig. 6.
ANCIENT PUEBLO POTTERY PIPE.
Sikyatki, Arizona.
Cat. No. 156154, U.S.N.M. Collected by Dr. J. Walter Fewkes.

Fig. 6 is a pottery specimen, which might well answer the description of one of Montezuma's varnished pipes, referred to by Prescott. It is $2\frac{1}{2}$ inches long and about three-fourths of an inch wide across the mouthpiece. The clay from which this pipe was made was finely pulverized, and so far as can be seen contains no ground shell or sand, such as is usually found in aboriginal pottery, and which was supposed to be intended as a tempering, to prevent cracking in drying or heating. On each of the ends of this specimen, for a distance of one-half an inch, there is a perfectly smooth and dark brown, almost black, glazed surface. The raised portion of this tube gives the effect of a jacket shrunken on, which is covered by a series of closely incised lines, forming a band, as though made by wrapping a thread on the clay while it was in the plastic condition. This pipe might well be taken for varnished wood by anyone not familiar with the material.

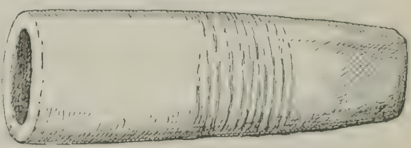

Fig. 7.
ANCIENT PUEBLO POTTERY PIPE.
Sikyatki, Arizona.
Cat. No. 156130, U.S.N.M. Collected by Dr. J. Walter Fewkes.

Fig. 7 is also a pottery tube from Sikyatki, of pinkish red color, quite symmetrical in shape, the type of which is not dissimilar to like objects found as far north as the State of Ohio. The type is common throughout the whole pueblo region. The specimen figured has a dull glazed surface, without polish, and similar thread marks to those referred to on fig. 6.

[1] Hernando Alarcon, Relation de la Navigation et de la Decouverte, p. 307, Paris, 1838.
[2] History of the Conquest of Mexico, I, p. 153, Philadelphia, 1860.

These thread marks look as though the thread wrapped around the plastic clay had been left on while the pottery was going through the cooking process, being burned off in the baking.

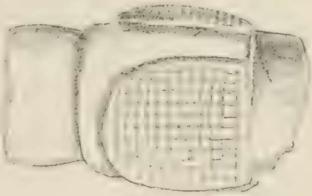

Fig. 8

ANCIENT ORNAMENTAL PUEBLO POTTERY PIPE

Sikyatki Arizona.

Cat. No. [illegible] U.S.N.M. Collected by Dr. J. Walter Fewkes.

Fig. 8, from Sikyatki, and also made of pottery like the others, is a pipe of a dull gray color. It is elliptical in cross section, and though a part of the bowl upon one side has been broken away, sufficient remains to show its original form. On the broader sides of this pipe upon the band there is a slightly raised surface, upon which are intersecting lines, evidently cut into the earthenware subsequently to its baking. This specimen looks as though the incised marks were intended to represent conventional birds' wings, though it may well be that some other significance attaches to it.

Fig. 9 is from the pueblo of Taos, in New Mexico. Dr. Fewkes obtained it by purchase, and therefore it is impossible to speak positively concerning its age, though it belongs to the same type as the preceding specimens, and if of a different period the characteristics remain constant. It is of glazed black pottery, containing a slight admixture of finely pounded shell, its lines of ornamentation being cut through the surface subsequent to the firing of the clay. It is 6 inches long, having a greatest diameter of 1 inch, and a circular cross section.

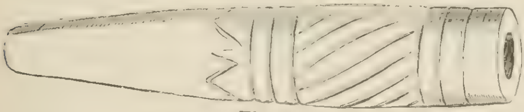

Fig. 9.

PUEBLO POTTERY PIPE.

Taos, New Mexico.

Cat No 176391, U.S.N.M. Collected by Dr. J. Walter Fewkes.

Fig. 10, a light gray earthenware from Nambe, New Mexico, was also obtained by Dr. Fewkes by purchase. It is 3 inches long and for two-thirds of its length is 2 inches wide, due to the wing-like projections attached to the elongated conoidal tube. These wings, while apparently intended for ornament, would answer perfectly for holding the pipe when heated. The type is primitive and common to the territory of the cliff dwellers.

Fig. 10.

PUEBLO POTTERY PIPE.

Nambe, New Mexico.

Cat. No. 176395. U.S.N.M. Collected by Dr. J. Walter Fewkes.

Fig. 11, a hard-burned red pottery tube from Jemez Springs, New Mexico, collected by Mr. J. M. Shields, belongs to the form common

throughout the southwestern United States. The pipe on its outer surface is covered by peculiar protuberances, not unlike large coffee grains set on edge, as though the clay in its plastic condition had been pinched up by the thumb and forefinger. A pipe having similar coffee-like grains upon its surface is in the collection of Mr. Andrew E. Douglass, of New York, and is said to have been found 6 feet below the surface of a bird shaped mound in Eastman, Crawford County, Wisconsin. The latter specimen, however, is of the rectangular type, with an unusually large bowl, the pottery of which is a mixture of clay and shell.

There are a number of pipes of the Pueblo type in the collection of the University of Pennsylvania, which were found in the ruins of the cliff dwellers of the Mancos Canyon in Colorado, one of which, 3¼ inches long, has a wooden bowl with a separate stem, made apparently of catlinite: yet another, with slightly shorter tube, has a catlinite bowl with a bone stem. The stems of each are held in place by the gum of the grease wood (*Sarcobatus*). There is also in the same collection a short, hard-burned pottery tube of this type, said to be from ancient Mexico, upon the surface of which there is a rudely modeled head of a duck, the eye being pierced through. The stem of this latter pipe has been formed by leaving a stalk of grass running through the clay into the bowl, so that in burning, the woody fiber disappears, leaving a clear channel for the smoke to pass through, which is a feature common to pipes of the Southwest. During the summer of 1897, Dr. Fewkes, at Four Mile Ruin, near Fort Apache, in Arizona, found a number of pipes of the cigarette type, one of which is made from a stalagmite. The specimens from this ruin do not appear, however, to be so ancient as those from Sikyatki. The writer has seen a photograph of a stone pipe excavated from an ancient grave on the "N. H." ranch, in New Mexico, collected by the Rev. Dr. Niess, of an elongated conical shape, very similar to the pipes from the coast of California, upon which are four longitudinal color stripes corresponding to the cardinal quarters. This pipe is about 8 inches long and similar to that represented on the Palenque tablet, and in the Manuscript Troano. The only other pipe having artificial color which has come under the writer's notice is a hard-burned pottery specimen from the cliff ruin of Mancos, Colorado, in the collection of the University of Pennsylvania, the bowl of which has been broken, the interior being smeared with some white color, probably connected with ancient burial customs. The University of Pennsylvania also possesses a number of bowls of tubular pipes, some made of shale and others of slate, the stems of which were evidently held by means of some foreign substance, as was the case with the pipes from California; and there are indications that in the middle Atlantic Coast States the same method of attaching the stem was

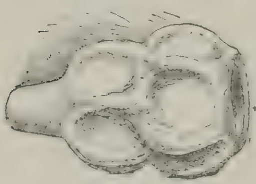

Fig. 11.

PUEBLO POTTERY PIPE.

Northern New Mexico.

Cat. No. [illegible], U.S.N.M. Collected by J. M. Shields.

employed. At Tusayan, New Mexico, as noted by Dr. Fewkes—and his remarks would apply equally to North America generally—"Indian customs are handed down through long periods with but slight variations. At Tusayan, native tobacco (*Nicotiana attenuata*) was used in the ceremonies. The Indians there smoke, however, the leaves of various plants, as they use various mixtures in their religious rites. The one who controls the pipe must light it and hand it immediately to the chief, friendly words being exchanged between the two. The chief blows the smoke toward the four cardinal points, upward and downward over the altar. They believe that the smoke is the cloud symbolized by it. They use the utmost care in making the mixture of tobacco which is to serve for this sacred purpose, and the pipe must be lit with fire produced in the manner prescribed by the rite. All ceremonies commence with this brotherly smoking."[1]

Fig. 12.
ANCIENT CLAY PIPE.
San Juan River, New Mexico.
Cat. No. 19791, U.S.N.M. Collected by Charles Aldrich.

Dr. Fewkes informed the writer that the plants of which the mixture used in the pipe was composed were valued largely according to the distance from which they came, and a plant from Colorado, which he gave a Pueblo Indian in New Mexico, was said to be good pipe medicine to smoke for that reason. In ceremonial smoking, or, in fact, in any of the more serious functions, the white man's manufactured tobacco was not considered valuable. "The xochiocotzotl, commonly called liquidambar, is the liquid storax of the Mexicans. It is a great tree, its leaves being similar to those of the maple, white in one part and dark in the other, disposed in threes. By an incision in the trunk they extract that precious resin called by the Spaniards liquidambar, and the oil of the same name is still more odorous and estimable. They also obtain liquidambar from a decoction of the branches, but it is inferior to that which is distilled from the trunk."[2]

The Sia Indians are said to smoke a thin cigarette, lighted from a long stick; the boys of the Sia were, however, never seen smoking.[3]

In the sixteen-song snake dance of the Moki Indians, both before the dance begins and after it is over, Dr. Fewkes found that the shape of the pipe smoked had no significance; but the pipe which was employed at the end of the eighth song was invariably one of the old-fashioned tubular conical pipes of the same character as those used by the ancient inhabitants, as evidenced at Sikyatki.

Fig. 12, a pueblo pipe from the San Juan River, New Mexico, collected

[1] Catalogue of the Hemenway Collection in the Historico American Exposition of Madrid, p. 283, Report of the Columbian Historical Exposition, Madrid, 1892.

[2] Clavigero, History of Mexico, I, p. 44, Philadelphia, 1817, translated by Charles Cullen.

[3] Matilda C. Stevenson, The Sia, 11th Annual Report of the Bureau of Ethnology, p. 105.

by Charles Aldrich, is made of black pottery, the clay having been mixed with a large proportion of sand. It is burned extremely hard and molded by hand, the stem hole being made by burning out a stalk of grass left in the plastic clay.

TUBULAR PIPES OF THE NORTH AMERICAN INDIANS GENERALLY.

There is in the U. S. National Museum collection a black pottery specimen of the tube, about the shape of a cigar and the size of one (Cat. No. 47759) from San Juan, New Mexico, which is in the Abbott Collection. It is of a dull black color, resembling stone; the upper rim of the bowl, having been cracked, is neatly repaired or reinforced by binding it around with fine sinew thread wrapped until it has formed quite a band. This mode of repair is primitive and interesting as being a probable survival of ancient methods.

Another and unique pipe is a tube in the U. S. National Museum having a square exterior, and is made of black glazed pottery. It was collected by Col. James Stevenson at Santa Clara, New Mexico, and has a rude arrow incised on opposite sides of the tube, the other sides having the rude ornamentation of a bow (Cat. No. 47492).

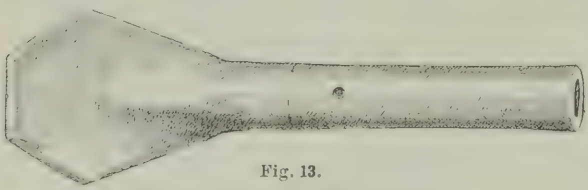

Fig. 13.
TUBULAR IMPLEMENT, PROBABLY PIPE.
Compact slate.
Boone County, West Virginia.
Cat. No. 90713, U.S.N.M. Collected by W. C. Norris.

Fig. 13 is a tubular implement, of a compact variety of slate, collected by Mr. W. C. Norris from a mound in Boone County, West Virginia. This tube is 8⅝ inches long, with a uniform diameter of 1 inch, the perforation, except at the flattened end, being of a diameter of three-fourths of an inch. This tube unfortunately has been broken, the flattened mouthpiece of which at its widest part measures 2¾ inches across, has a thickness of scarcely one-fourth of an inch; through this a perforation about three-sixteenths of an inch in diameter has been drilled into the larger part of the tube. The walls are about one-eighth of an inch thick, the opening having been drilled by means of a hollow metal drill point.

This tube is similar to one figured by Squier and Davis from the neighborhood of Chillicothe, Ohio, which they considered superior to anything of which the present Indian was capable.[1]

There is one of these tubes made of pottery in the Museum of the University of Pennsylvania, 4¼ inches long, found in Portage County, Ohio.

[1] Ancient Monuments of the Mississippi Valley, p. 225, Smithsonian Contributions to Knowledge, I.

The writer is inclined to class this tube among the pipes, though he does so with some doubt. It should not, however, be confounded with those carefully polished implements having thin walls bored by means of tubular drills to within one-half or one-fourth of an inch of the end, which are flat, and have one-eighth-inch holes bored through them, and which were probably intended to be used as horns, as they certainly answer that purpose perfectly, giving as they do a strong, clear note. The surfaces of these tubes are finished to a high polish and appear to the writer to be due to the use of tools of civilized men. There is a striking similarity in the mouthpiece of this tube and the specimen figured from the ancient ruin of Sikyatki.

Fig. 14 is "a tube of copper collected by Prof. E. B. Andrews on Mr. George Connett's land, on Wolf Plain, Ohio, which was found with human remains. Professor Putnam describes it as being made of sheet copper hammered over wood, a little hole one-eighth of an inch in diameter being cut or punched to one side of the center of the mouthpiece. The tube, he says, is 5½ inches long and three-fourths of an inch in diameter in the circular part and 2 inches at the flattened end." Professor Putnam calls attention to the possibility of this class of implements being intended for pipes. Tubes found in the collection of the U. S. National Museum intended as horns or pipes vary all the way from 2 inches to 10 inches in length, with a diameter of from one-half an inch to 2 inches. Usually they are made of stone, though tubes of pottery are not unknown. The Indian was as a rule skillful in selecting material for pipes, the larger proportion of which were made from chlorite or steatite, though sandstone, quartzite, and other minerals equally unsuited for pipe making are encountered at times. The cross section of the tubular pipe varies between a flattened ellipsoid and a circle. They are conoidal in their longer diameter, having usually a large bowl gradually decreasing in size to the mouthpiece. While it may reasonably be inferred that the original pipe was a reed, or hollow bone, or a piece of wood split and scooped out, or possibly a horn, there is no doubt that everything capable of holding tobacco has at one time or another been used by American Indians for smoking, instances being known where birch bark, lobster claws, and, most inappropriate of all, stone coal has served for pipe making.

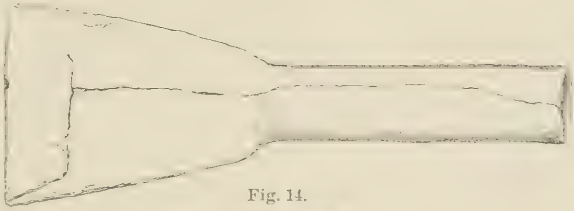

Fig. 14.

COPPER TUBE.

Mound Wolfe Plain, Ohio.

Cat. No. 8993, Peabody Museum. Collected by E. B. Andrews.

Fig. 15 is a pipe made from the metatarsal bone of a deer, than which it were difficult to imagine a more primitive production. It has a length of 7 inches. One end of the bone has been hammered off, while the

opposite end has been cut down to a size which could readily be placed in the mouth, leaving the natural cavity to hold the smoking material.

Fig. 16 shows that the Indian has been taught the frailty of the simple bone when exposed to the heat of the burning leaves. This bone is of the same character as that of the preceeding pipe, and has been reenforced with strips of rawhide wrapped on wet and allowed to shrink. Except the cutting off and wear on the ends of these bones there appears to have been nothing done with either, other than the reenforcement of the hide.

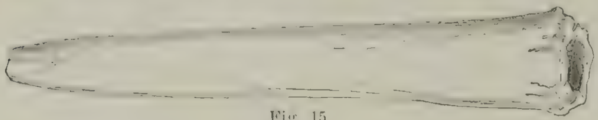

Fig. 15.

BONE PIPE.

Kiowa Indians.

Cat. No. 152940, U.S.N.M. Collected by James Mooney.

The writer is informed by Capt. H. L. Scott, of the U. S. Army, that the pipe used in the medicine dance by the Kiowas, which is held in the summer, is in the custody of the medicine keeper and descended to this tribe from the Arapahoes, who in turn received it from the Crows in the far north. It is straight and made of a black stone. The sacred pipe of the Arapahoes, which has an antiquity, according to their tradition, as great as that of the tribe itself and which is valued beyond price by them, is a straight tube made of a black stone and is at present in possession of the northern division of the tribe, which is in Wyoming. White Beaver, in a letter to Dr. E. A. Barber, of Philadelphia, says, "From 'Mediçine Smoke'—big fire, or He-mon-e-gah—a son of the head chief of the Winnebagoes, I yesterday heard a legend of the use of sha-sha or red willow" [*Salix purpurea*], "not tobacco." He refers to the unwrapping of "a pipe made from the shin bone of an elk which was employed at a treaty of peace made between the Winnebagoes and the Sioux, which was only broken when the pipe was polluted by the chah-de—tobacco of a nation or place where the sun rises."

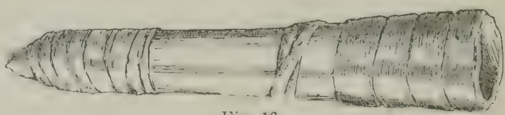

Fig. 16.

COMANCHE BONE PIPE.

Cat. No. 6901, U.S.N.M. Collected by Edward Palmer.

Prince Maximilian says of the pipe of the Assinniboines that it was generally made of blackish stone or dark clay, in which they smoked the herb kinnikinick, or the leaves of the bearberry (*Arctostaphylos uva-ursi*), mixed with tobacco. He refers also to a pipe used by the Indians of the upper Missouri, who employ it on warlike excursions, the bowl and stem of which are in the same line, as a tube.[1]

The Blackfeet use in their pipes the bearberry, which they call "sakakomi," and which in company each person passes to the left.[1]

There appear to be but few exceptions to the rule that the straight

[1] Travels in the Interior of North America, p. 196, London, 1843.

tube was the sacred pipe of the Indian, and that this has been a general and ancient practice may be inferred from finding such tubes throughout the whole country where the pipe was smoked.

Captain Marcy refers to the Comanches being extravagantly fond of smoking tobacco, which they called pah-mo, mixed with the leaves of sumac[1] (*Rhus trilobata*).

Fig. 17 is a serpentine tube from Wilkes County, Georgia, collected by Miss Fannie Andrews. It is 7 inches long, with a diameter of 1¾ inches at the widest part. This pipe is very similar in exterior as well as in interior finish to those so often found in the graves on the islands off the coast of California, and in shape differs in no essential from the bone pipe of the Kiowa and Comanche Indians. The tube of this pipe has been drilled its entire length by means of a solid drill point, the bowl and smaller end being subsequently enlarged by means of scraping or gouging with a narrow tool, apparently made of stone, the striæ of the drill point and gouge each being distinctly discernible. Similar specimens are quite common on the coast of California, a few being known to have rude ornamentation of incised lines or designs in low relief. A remarkable peculiarity of this Georgia pipe is shown in the three tracks, apparently of a bird, on the surface, traveling in a spiral direction from the bowl toward the mouthpiece. These three tracks are etched lightly into the stone and probably have some especial significance. Such tracks would indicate those of the turkey at Moki and the direction in which the smoke traveled to the mouth. Two similar tracks are figured in the cavity of a chunkee stone found in a mound at Belmont, near Camden, South Carolina, and represent one track on each side of the hole through the center of the stone.[2]

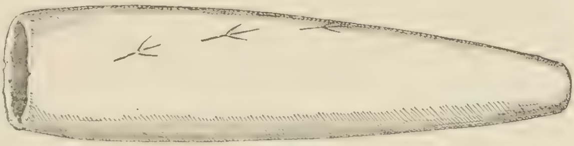

Fig. 17.

ANCIENT STONE TUBULAR PIPE.

Totemic turkey tracks cut on surface.

Wilkes County, Georgia.

Cat. No. 34721, U.S.N.M. Collected by Miss Fannie Andrews.

The enlargement of the smaller end of this tube is evidently for the purpose of inserting a mouthpiece of wood, or bone, or possibly even of stone. The California pipes had mouthpieces of bird bones held firmly in place with bitumen, similar to those of the cliff dwellers which were held with gum of the greasewood. These mouthpieces served the purpose of preventing in a measure the tobacco or plant consumed from escaping into the smoker's mouth.

Fig. 18, a California serpentine pipe of most unusual shape, is 6½

[1] Randolph B. Marcy and George B. McClellan, Exploration of the Red River of Louisiana, p. 102, Washington, 1854.

[2] Bulletin No. 2, University of Pennsylvania, December, 1897, p. 79, plate 5, fig. 2.

inches long, with a diameter of 1¼ inches at the mouth of the bowl, which is circular in cross section, though elliptical at the middle, where the greatest diameter is 1¾ inches. The bowl and stem are, however, not in the same plane, owing to having been drilled from opposite ends, the perforations being intended to intersect about the middle, at which point, as indicated in the figure, the wall has been perforated. Both bowl and stem openings have been enlarged subsequent to drilling by gouging. Into the stem a hollow bird bone, 1½ inches long, fastened by means of bitumen, served as a mouthpiece. The perforation of the wall would indicate that this was an unfinished article were it not for the mouthpiece, which indicates that this hole in some way was artificially closed, probably with the same bitumen with which the mouthpieces were held in place. The lower hole is perforated from side to side, and one would be inclined to suppose it was intended for the attachment of a string so commonly observed in certain types were it not that this appears to be a unique specimen among pipes of the type which belongs to those having a straight hole from end to end. This lateral hole is a natural cavity in the stone, the edges of which have been smoothed in grinding the surface. Its discovery in the blocking out of the pipe, which was always done before boring the holes, has led to the curve in the specimen being made in order to preserve the cavity, which was evidently retained because of some superstition in connection with it, probably attaching unusual properties to the pipe itself. The California pipes are almost invariably elongated cones similar to the pipe from Georgia (fig. 17) and range in length from 3 to 10 inches. They were ordinarily made of serpentine, though specimens of talcose slate and steatite were found at La Patera and at Dos Pueblos.[1] The tobacco pipes of the natives of San Gabriel Mission, California, are said to have been made of reeds,[2] from which their conical stone pipes would be a natural development.

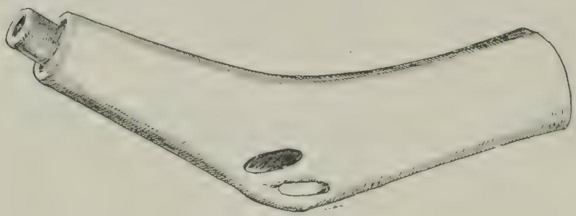

Fig. 18.

STONE TUBE WITH BONE MOUTHPIECE.

Santa Barbara, California.

Cat. No. 20218, U.S.N.M. Collected by S. Bowers.

Venegas (about 1758), referring to stone tubes being employed by the medicine men of California, says: "One mode was very remarkable, and the good effect it sometimes produced heightened the reputation of the physician. They applied to the suffering part of the patient's body the chacuaco" (presumably the conventional tube) "or a tube formed out of a very hard black stone. Through this they sometimes sucked and

[1] Report upon the U. S. Geographical Surveys west of 100th Meridian, VII, Archæology, p. 126.

[2] Edward T. Stevens, Flint Chips, p. 525, quoting California Farmer, May 11, 1860.

at other times blew, but both as hard as they were able. Sometimes the tube was filled with cimarron, or wild tobacco, lighted"[1] [*Nicotiana attenuata*].

The same practice is referred to about 1766, while these same people were still living under primitive conditions. It was said "the priests never abandon the Californian, but on the contrary they redouble their cries, and they are heard on the whole rancheria when the sickness gets to the point where herbs, sweets, chichuaco and cimarron or wild tobacco no longer produce effect."[2]

Professor Putnam's description of smoking by the Klamath Indians would probably apply equally to the smoking of the California or other tubular pipes. He says "it amused me to see an Indian bending back his head to bring the pipe in a vertical position, so as not to lose any tobacco while taking a long draught, which he inhales the longer to enjoy the opportunity, as the pipe must be passed on."[3]

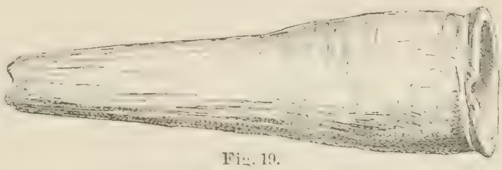

Fig. 19.

UNFINISHED TUBULAR STONE PIPE.

Cook County, Tennessee.

Cat. No. 91681, U.S.N.M. Collected by J. W. Emmert.

Dr. George M. Dawson refers also to straight pipes of steatite, shaped very much like a cigar holder, which are marked with incised lines, found among the Shushwap people at the confluence of the Fraser and Thompson rivers in British Columbia.[4]

Fig. 19, it will be observed, was intended for a tubular pipe, and was found at Newport, Cook County, Tennessee, by Mr. J. W. Emmert. It is of a grayish serpentine, 4¾ inches long, with an exterior diameter of 1½ inches at its thickest part. It is, however, an elongated, flattened elipsoidal cone, the raised rim of which is quite unusual and somewhat ornamental. This specimen is in an unfinished condition and therefore doubly interesting, as it shows much of the process by which such pipes were made. The bowl has been excavated to a depth of barely 1½ inches, and the stem hole is bored not over three-eighths of an inch, apparently by means of a stone drill, as the striae are quite irregular, though the cavity of the bowl has been enlarged subsequent to drilling by a sharp-pointed tool, which left longitudinal marks similar to those so commonly noticed in specimens found in the States along the Middle Atlantic as far west certainly as the Mississippi River, along the Missouri, and in the Rocky Mountains. The common drill point of the California coast appears to differ from those used in the East, the former being made of a gritty stone of ovoid shape,

[1] Charles C. Jones, Antiquities of the Southern Indians, p. 363, New York, 1873, quoting Natural and Civil History of California.

[2] Histoire de la Californie, I, p. 133, translated from English, Paris, 1766.

[3] Reports of the Peabody Museum of American Archæology, II, p. 268.

[4] Transactions of the Royal Society of Canada, IX, 1891, p. 12.

several fine specimens of which, some still showing the asphaltum by which they were attached to the drill shaft, are preserved in the American Museum of Natural History in New York City. The surface of this specimen shows distinctly both the circular and the longitudinal striae of the stone or shell scraper with which the form has been given. Pipes of this type with few exceptions, so far as the writer has observed, have been drilled by means of solid drills, though, as showing that there are exceptions at times, Thruston[1] illustrates one partially excavated which was bored by means of a hollow drill.

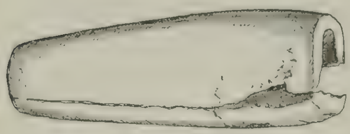

Fig. 20.

TUBULAR PIPE OF SOFT, INDURATED CLAY.

Santa Barbara, California.

Cat. No. 20432, U.S.N.M. Collected by Paul Schumacher.

Fig. 20, though a tubular pipe, differs materially in shape from the usual California type. This one is from Santa Barbara, and was collected by Paul Schumacher, its length being 3 inches, with a diameter varying from three-fourths of an inch to 1¼ inches. This tube is made from a clayey substance quite as soft as chalk; in color it is a light pink, and the specimen might well be taken for pottery by a casual observer, or even for catlinite. Mr. Stephen Powers states that the Nishinam Indians of Bear River, California, smoke a wild tobacco called by Prof. Asa Gray *Nicotiana quadrivalvis*, and by Professor Bolander *N. plumbaginifolia*, which they use alone or mixed with the leaves of manzanita (*Arctostaphylos glauca*). Mr. A. W. Chase says the Klamaths cultivate it, which is the only instance of California cultivation. He says the pipe pan-em-ku-lah is generally made of serpentine (of wood nowadays), shaped like a cigar.[2]

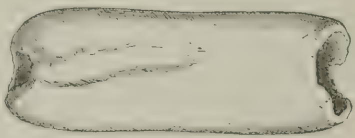

Fig. 21.

SANDSTONE TUBE.

Frankfort, Kentucky.

Cat. No. 11572, U.S.N.M. Collected by Robert Peter.

Prof. J. T. Rothrock obtained from the shell mounds in California a tobacco, probably the *Nicotiana clevelandi*, and says the *N. rustica* (now rare) was formerly cultivated there. In Arizona they cultivated the *N. tabacum*, known as Yaqui tobacco, and refers to Gray's saying that *N. quadrivalvis* was cultivated from Oregon to Missouri. He also calls attention to the Hudson's Bay men using the dried leaves of the bear berry to eke out the supply of tobacco.[3]

Fig. 21 is a sandstone pipe 3 inches long, having a greatest diameter of slightly more than an inch. It is from Frankfort, Kentucky, and was collected by Dr. Robert Peter. This tube has been bored through by a one-half inch drill; for approximately 2 inches of its length the

[1] Antiquities of Tennessee, p. 192, fig. 90.

[2] Contributions to North American Ethnology, III, fig. 43.

[3] Letter to Dr. E. A. Barber of Philadelphia, Pennsylvania.

perforation has been enlarged to form a bowl by the usual gouging process the length of the interior. The smaller end of this tube is too large to be comfortably held in the mouth unless it had a mouth-piece of bone, such as was inserted in the California tubes. It is, however, very noticeable in primitive pipes, even such as were apparently held in the smoker's mouth, that it is rare to observe any evidence of wear such as would be caused by the smoker's teeth coming in contact with the surface of the stem. The action of fire upon the inner surface of this tube is quite distinct.

Fig. 22, from Dan River, Virginia, collected by Dr. A. Coleman, is a conical tube of primitive pottery 3 inches long, the larger end being approximately 2 inches across and the smaller end slightly more than $1\frac{1}{4}$ inches in diameter. The clay from which this tube was made has been mixed with coarse quartz sand, a tempering material not uncommon in aboriginal pottery in the eastern central parts of the United States. The walls of this tube are unusually heavy in comparison with those of similar ones of stone, they being about three-eighths of an inch thick, and show the cord marks in the pottery quite distinctly. A tube very similar to the one here figured, but slightly curved in its longitudinal section, was found near Bennings Bridge, in the District of Columbia, and Mr. Clarence B. Moore found, at a depth of 6 feet, in a shell heap on the upper St. Johns River, Florida, an earthenware pipe over 7 inches long in the form of a bent, flattened tube.[1] The characteristics of this latter tube are very much like those of the Bennings Bridge specimens, and there can be little doubt that all of them are tobacco pipes, the pottery having every indication of age. Tubular pipes have also been noted in Rhode Island, and Perkins refers to them in Champlain Valley, Vermont.[2]

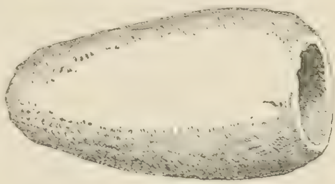

Fig. 22.

POTTERY TUBE PIPE.

Dan River, Virginia.

Cat. No. 16777, U.S.N.M. Collected by Dr. A. Coleman.

Abbott also refers to a tubular smoking pipe from Lawrence, Massachusetts, which he says differs in no particular from those found in California.[3]

The almost endless variety of material from which pipes were made is shown in the case of the Micmac Indians of Nova Scotia, who "sometimes used tobacco pipes made of birch bark, rolled in the form of a cone, and which, of course, are perishable."[4] A tube of this character from a mound in Henderson County, Illinois, made from a brown indurated clay, is in the collection of the U. S. National Museum.

[1] American Naturalist, July, 1894.

[2] G. H. Perkins, The Calumet in the Champlain Valley, Popular Science Monthly, December, 1893, p. 245.

[3] C. C. Abbott, Primitive Industry, p. 330, fig. 322, Salem, 1881.

[4] J. W. Dawson, Fossil Men, p. 97, Montreal, 1880.

Fig. 23 belongs to another and distinct type of stone tubes and was found in the Etowah Mound, Bartow County, Georgia, and is in the Steiner collection now on deposit in the U. S. National Museum. This object is as symmetrical in outline as it is perfect in finish; stem and bowl, both outside and inside, are equally well and carefully ground; the walls are, approximately, one-eighth of an inch in thickness throughout. The specimen is 2¼ inches long, the bowl being 1¼ inches in outer diameter and the stem five-eighths of an inch. It appears probable that we have here the form of the medicine pipe referred to by so many of the early writers, or is it but a freak of the native tobacco pipe? Coreal says they do not resort to bleeding when they are sick, as is done elsewhere, but call in their jaouans, who are priests and doctors. These suck that part of the body which is most painful, at times with the mouth, also with the chalumeau, after making a slight incision near a vein.[1]

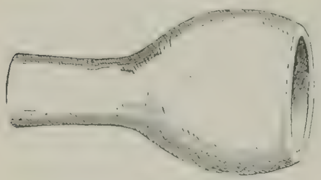

Fig. 23.

TUBE AND CUP SHAPED IMPLEMENT.

Bartow County, Georgia.

U.S. National Museum. Collected by Roland Steiner.

Coreal, relating his experiences between 1666 and 1697, is one of the earliest writers who employed the word *chalumeau*, a reed, in referring to the pipe. It is said to be a word of Norman origin and the one from which "calumet" is derived. A similar specimen to that in the Steiner collection is in the U. S. National Museum, and was found by Capt. C. E. Bendire on the John Day River, California.

Fig. 24 is a comparatively modern California pottery pipe 3½ inches long, with a diameter of five-eighths of an inch at the mouth of the bowl. Except that both bowl and stem are longer, there are retained in this specimen all of the characteristics of the Pueblo pipe of a very primitive period, for there can be little doubt that the California pipe and that of the Indians south of California are nearly related, the former probably adopting the custom from their southern contemporaries, as the general distribution appears to have gradually traveled northward. This pipe has elegance of form, and the clay from which it is made is of very smooth texture, the walls of the bowl not being more than one-sixteenth of an inch thick. A Mojave pottery pipe of this character is in the Davenport Academy. The writer is informed by Dr. Franz Boas that there is a pipe of this type made of green serpentine in the American Museum of Natural History, New York, obtained from the Fraser River Indians.

Fig. 24.

RED POTTERY TUBE AND BOWL PIPE.

Colorado River.

U. S. National Museum. Collected by Edward Palmer.

[1] Voyages de François Coreal aux Indes Occidentales, Amsterdam, 1722, I, p. 39, translated from Spanish.

Lewis and Clarke in 1804 describe a pipe which was possibly of this type, found among the Shoshonees, which was "made of a dense transparent green stone, very highly polished, about $2\frac{1}{2}$ inches long and of an oval figure, the bowl being in the same situation with the stem. A small piece of burnt clay is placed in the bottom of the bowl to separate the tobacco from the end of the stem, and is of an irregular round figure, not fitting the tube perfectly close, in order that the smoke may pass with facility."[1]

The Indians of northern California, according to Prof. Otis T. Mason, formerly smoked a wild tobacco, *Nicotiana quadrivalvis* (Pursh) *N. plumbaginifolia*, which they smoked alone or mixed with the dry manzanita leaves, *Arctostaphylos glauca*, said to have a pungent, peppery taste which is not disagreeable. The pipes of the Hupa are, as Professor Mason says, conoidal in shape, and are of wood alone, stone alone, or latterly of stone and wood combined.[2]

While it is impossible to speak with certainty of the antiquity of the tobacco pipe in California, it may be said that the large collection in the U. S. National Museum from that State appears to be contemporaneous with the early arrivals of Europeans, probably Spanish, if we may form an estimate from those things found in the graves in association with them, such as glass beads, bird-bone whistles and flutes. The tubular pipes, it has been attempted to demonstrate, are found scattered over a large part of the continent, and they were quite commonly smoked by means of stems fastened into an enlargement in the smaller end, though there are evidences that at times these tubes were smoked without stems. Their shapes vary greatly, from tubes made of reeds, having, of course, parallel walls, to conical specimens more or less elongated: we may say from a foot or more to 3 inches or less in length. Schumacher found in the collection of the U. S. National Museum a tubular conical pipe from Oregon (Cat. No. 20339, U.S.N.M.), which is in an unfinished condition, having been drilled several inches from one end with a five-eighths inch hole, while from the opposite end a hole slightly less in diameter has been made. A tube of the hourglass form (Cat. No. 170477, U.S.N.M.) from South Carolina has been bored, so far as one can see, in exactly the same manner. The perforated articles of primitive peoples will almost always be found drilled from opposite sides, due to there being less friction in this method and consequent greater ease in drilling than when the work is all done from one end.

Fig. 25 is simply a cone cut apparently from manzanita wood. It is 13 inches long with a greatest diameter of 2 inches, tapering gradually to $1\frac{1}{4}$ inches at the smaller end. If this pipe were sawed in two one-

[1] Lewis and Clarke's Expedition to the Rocky Mountains, I, p. 366, Philadelphia, 1814.

[2] The Ray Collection from Hupa Reservation, Smithsonian Report, 1886, Pt. 1, p. 219.

third of the way from the smaller end it could not be distinguished in form from the elongated conical stone pipes usually found in graves and burial places of the islands along the California coast. This pipe appears to have been perforated by burning. The walls vary from one-sixteenth of an inch in thickness at the smaller end to nearly one-half

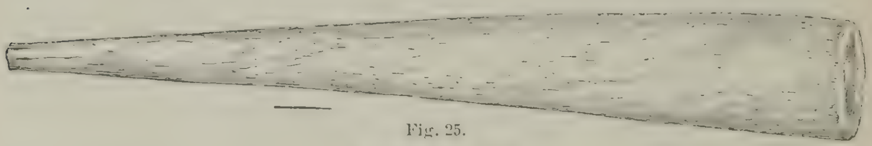

Fig. 25.

TUBULAR WOOD PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

an inch at the larger. The outer sides appear to have been smoothed by means of sandpaper, though the same appearance could be imparted to the specimen with any gritty sandstone or with sand alone. These pipes are made from any available wood, those which best resist fire being preferred, one of the best and most usual being the laurel.

Fig. 26 is an all-wood pipe of Hupa manufacture, $13\frac{1}{4}$ inches long,

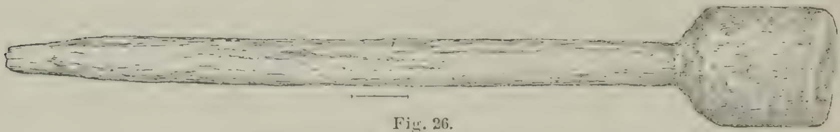

Fig. 26.

WOOD PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

that is of peculiar form. The bowl is $2\frac{1}{2}$ inches in greatest diameter, that of the stem being scarcely three-fourths of an inch thick. The bowl cavity consists of quite a shallow cup, the specimen having been rudely chopped out by means of an extremely dull tool, which gives one the impression that it would be a difficult pipe to smoke unless the smoker laid flat on his back.

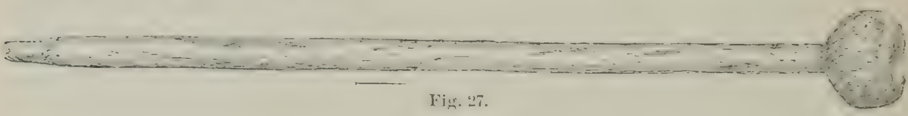

Fig. 27.

ALL-WOOD PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 27 belongs to the same type of all-wood Hupa pipes, and is more carefully finished than the last specimen, its surface being brought almost to a polish. It is 15 inches long, though the bowl is less than 1 inch in depth, with a diameter of $1\frac{3}{4}$ inches. Had the preceding specimen been ground to a uniform surface, as these pipes

usually are, they would have had bowls alike, though among the Hupa, to a greater degree than has been detected among other natives, pipes have been made of a greater variety in shape than has been observed to be the case with almost any other type with which we are acquainted. They appear to be comparatively modern, and it is strongly to be suspected that the multiform shape of the Hupa pipe has been largely influenced by the outside demand for specimens as curiosities. There is in no implement found in America a greater observance of conventionalism of form than is the case among the pipes, and in those localities where the greatest variety exists investigation demonstrates that the smoking habit itself has been adopted within the last century. These varieties are most marked along the Pacific coast among the Hupa and Babeens.

Fig. 28.

SANDSTONE TUBULAR PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 29.

STEATITE TUBULAR PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 28 is a fine-grained tubular sandstone, showing unusual mechanical skill in its manufacture, being 7 inches long, with a diameter at the larger end of three-fourths of an inch; the walls of the tube do not exceed one-sixteenth of an inch at the mouth of the bowl, increasing gradually to one-eighth inch at the smaller end. The outer surface is ground to a dull polish, and the interior shows striae running the length of the implement, made apparently by means of a file or similar tool.

Fig. 29 differs in no material respect from the simplest form of conical tubes found throughout the continent, except in the slightly raised rim around the smaller end. It is made of steatite, and has a length of 2⅝ inches. This rim is similar to one on the bowl of the unfinished pipe from Cook County, Tennessee (fig. 19), and would indicate that it was intended simply for ornament and not for the attachment of a string.

Fig. 30.

TUBULAR WOOD PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 30 is of wood, being the pipe used by the Hupas at the present time, and is 3 inches long, with a greatest diameter of three-fourths of an inch, the bowl being about seven-eighths of an inch deep, from which there runs a narrow stem hole to the smaller end.

Fig. 31 shows the shape of the tobacco bag of these people, and is made from strips of the roots of the spruce, split into strings and woven together; six buckskin loops are attached to its rim in such a manner

that their apices meet in the center of the opening. A long string is attached to one loop and is serially passed through all the others, by means of which the bag may be opened and closed at will by drawing the loops apart or by drawing the string. This bag would be found to differ little, except in material, throughout the continent. Some would make it of skin, while others would weave it from suitable fibers, and others again would probably fashion it from birch bark.

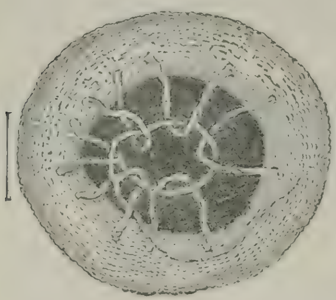

Fig. 31.

ROOT-PLAITED TOBACCO BAG.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 32 is a wooden pipe, 11 inches long, the bowl of which is made in the hourglass form, similar in outline to certain tubes found in the Middle Atlantic States. The bowl has been cut with a dull tool, but upon the stem are a number of crossed lines, intended to add to its ornamental appearance. Fig. 33 is made of hard wood, the bowl of which is carved in a series of octagons, chamfers, and holes, which give to this specimen quite an ornamental effect. The tube is $12\frac{1}{4}$ inches long, the bowl being seven-eighths of an inch in its greatest exterior diameter, and has a cavity 2 inches deep. Figs. 34

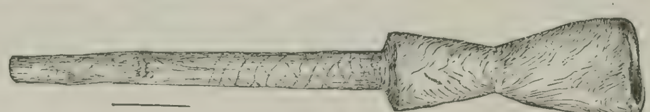

Fig. 32.

WOOD AND STONE PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

to 37, inclusive, show the most modern form of the Hupa pipe, which is made from different kinds of wood and serpentine. These pipes are most carefully polished, and are evidently made with modern tools. The remarkable feature of these pipes is shown in the serpentine bowl.

Fig. 33.

WOOD AND STONE PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 35 is set in a tapering wood socket, held in place by some kind of glue, the whole surface being subsequently ground and polished. Fig. 37 shows the pipe in its original skin case, with its strap for suspension. The American Indian pipes have always been most carefully

guarded by their owners, in cases or coverings of skin, basketry work, bark, or woven rags.[1]

The Northwestern California pipe has been referred to by Mr. Henry R. Schoolcraft, quoting Col. Roderick McKee, as "a straight stick, the bowl being a continuation of the stem enlarged into a knob and held perpendicularly when smoking."[2]

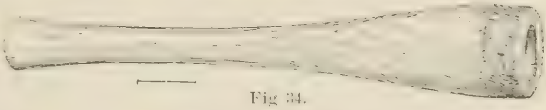

Fig. 34.

WOOD AND STONE PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

There is in the U. S. National Museum collection a small serpentine tube, collected by Rev. Stephen Bowers at Santa Cruz Island, California, 3 inches long, with a greatest diameter of five eighths of an inch; around the middle and on each end of which are three or four parallel incised lines, and on one end of which there yet remains attached, by means of asphaltum, part of a circular row of flat shell beads. A similar specimen from Santa Barbara is in the Douglass collection. While these latter tubes have perforations too small to allow of their being smoked as pipes, they are interesting as showing a peculiar beadwork on stone, which would likely be found also as an ornamentation of the tubular pipe, such having in fact been recorded in several instances.

Fig. 35.

WOOD AND STONE PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

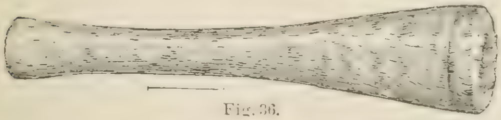

Fig. 36.

WOOD AND STONE PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

Fig. 38 shows a concretion found near Morgantown, West Virginia, which was supposed to have been of artificial

[1] Otis T. Mason, The Ray Collection from Hupa Reservation, Smithsonian Report, 1886, plates XV, XVI, pp. 219, 220.

[2] North American Indian Tribes, Pt. 3, pp. 107, 141, Philadelphia, 1847.

manufacture. A close inspection developed the fact, however, that the cavity was a natural formation, which had contained a cephalopod, a species of cystoceras. The circular cavity shows a succession of wavy parallel striae, which have every appearance of being made with a drill, which, however it would be impossible to give with any primitive implement, and it may well be doubted whether it could be done

Fig. 37.

WOOD AND STONE PIPE.

Hupa Reservation.

U. S. National Museum. Collected by Lieut. P. H. Ray.

with the most improved modern tools. While the bowl has the conoidal shape common to tubular pipes, one side is flat, while the other is rounded. It has a length of 2¼ inches with a width of 1⅝ inches, and is much harder than stone from which pipes are usually made. Around the flat side of this tube, where it apparently is attached to a base, a slight groove has been evidently artificially made to enhance the appearance; a most excellent illustration of the Indian's attraction to unusual shapes in natural objects.

The native American, however, does not appear to be alone in smoking straight tubular pipes, for Flinders, in the early part of the century, is quoted as referring to a tribe of Papuans puffing smoke through tubes.[1]

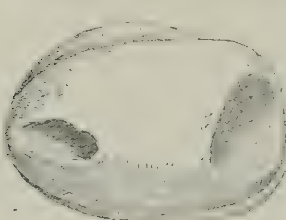

Fig. 38.

CONCRETION STONE.

Morgantown, West Virginia.

Collected by Dr. Walter Hough.

The natives of Sankum River, Africa, in about 5° south latitude, are said to use bone pipes, made from the metatarsal bones of deer,[2] similar to those referred to in this paper of Kiowa and Comanche origin.

It has been commonly supposed that to make a stone pipe required weeks if not months of patient labor. The writer has, however, demonstrated that with primitive tools, picking, grinding, and drilling, almost any pipe, such as those which have been used by American Indians, could be completed in less than three days' work and the more ordinary ones in a few hours. Instances of the discovery of conical tubes in different States and Territories could be multiplied were it necessary, but it is believed a sufficient number of illustrations have been given to impart a fair idea of the type. There appears no room to doubt

[1] J. W. Dawson, Fossil Men, p. 196, Montreal, 1880.

[2] Robert T. Pritchett, Ye Smokiana, 1890.

that the tubular and conoidal pipe is comparatively common throughout the continent and that it is the most primitive of all forms, as it is the one found over the largest area of the continent, it being also the type upon which there are the least evidences of file marks. Among all tubular pipes which have come under the writer's observation the mark of the file appears only once, and in that instance it is upon a small surface of a glossy specimen which may well be modern.

The surfaces of tubular pipes, with scarcely an exception, have every appearance of being made with stone tools, excepting, of course, the Hupa pipe. The drill marks in tubular pipes have also every indication of being made with primitive tools, and it is the only type found in the country upon which steel tool marks do not appear with such frequency as to indicate the contemporaneity of the white man: not of necessity that he made them, but that they were made with tools supplied by him. The shape itself of many of the American Indian tubes is such, and their ornamentation is of a character to lead to the conclusion that they are due to European influences. The aboriginal mechanic made at one bound a wonderful stride when he first became possessed of a blade of iron, even though it were but the hoop of a barrel; and how much greater was his advance when he became possessed of implements of steel! Every forward step in the art of sculpture or of carving throughout the known world has been chiefly due to the discovery of improved tools, which have limited possibilities. With the stone-pecking tool carving was possible, but slow, while sculpture in free action was an impossibility, because of the jar of the working tool. An attempt at the representation of free action is first found to be successful when the bronze blade supplanted the stone hammer, and statues were made from the softest stones, instead of from the granites and diorites which had preceded them. The steel blade and the rasp made the sculpture of marble in the round with free action first possible. Is it probable that the American Indian, alone of all the races of the earth, formed so startling an exception as to have carved perfectly in the round and to have had no period of rude art? The Indian was quick to appreciate and to employ tools which so materially lightened the labors of life as did those made of iron.

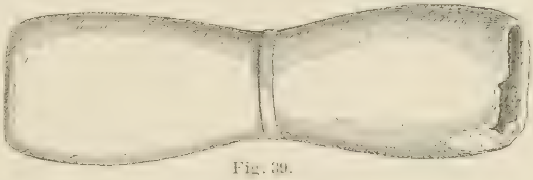

Fig. 39.

STONE HOURGLASS TUBE.

Nashville, Tennessee.

Cat. No. 5355, U.S.N.M. Collected by J. Varden.

Fig. 39 is a tube of the hourglass pattern, collected by Mr. J. Varden, from Nashville, Tennessee. With few exceptions, these tubes are made from steatite, and are more smoothly ground than is usually the case with conoidal pipes, and show a higher appreciation of art. They vary in length from 5 to 14 inches, with an exterior diameter of

from 1½ to 2 inches, the interior of the tube being one-third of an inch, or even less, across.

The tube figured is 6 inches long with a greatest diameter of 2 inches, gradually diminishing to 1½ inches. The contractions of these tubes often have bands encircling them, made at times in imitation of a rope or cord. Sometimes there are two or even three bands of different widths, intended apparently as ornamentation. The perforations are comparatively straight in these hourglass tubes, though there is a cast of a specimen in the U. S. National Museum which, upon the exterior, shows a decided curve. The curve once given to a tubular pipe, whether accidentally or by design, would be quickly recognized as an improvement upon the straight tube, thereby enabling one to smoke it with less discomfort than would necessarily result from the use of a straight pipe. It is difficult to believe that the white man, who has traded in stone implements from the time of John Smith's first voyage to the present day, did not also trade in pipes, especially as they, of all his possessions, appear to have been the objects for which the Indian had the greatest veneration and to which he attached the greatest value, and consequently for which he would pay the most liberal prices. The numbers of trade pipes found in Indian burial places strongly attest the extent to which the trade between the whites and the Indians eventually extended. There is scarcely an account of a treaty between whites and Indians in which the pipe and tobacco tongs do not appear among the presents exchanged, and there are records of "great pipes" being presented, by both French and English governors, to their red allies as symbols of amity and pledges of good will. As noted in reference to other tubes, those of the hourglass form appear to have been originally drilled by means of solid points, the perforation being subsequently enlarged by gouging out each end, and leaving a narrow hole or channel connecting the two bowls or ends. These tubes have been supposed to have served among other purposes as astronomical instruments, a suggestion hardly deserving serious consideration. This type, the writer thinks, were employed as pipes, a belief in which many now concur. It appears that tubular pipes were not invariably smoked by placing the smaller end in the mouth, for Dr. Fewkes found the Moki Indians lighting conical pipes and placing the larger end to the mouth, blowing smoke through the smaller end until the lighted material was consumed. When it is remembered how persistently customs are handed down among the Indians, and particularly pipe customs, or quasi-religious invocations, which are conducted by societies of men whose function is to act in conformity with traditional rituals, we can well believe that similar implements, even in remote antiquity, were put to like uses. The resemblance of pipe customs from the most widely separate parts of the continent appear to attest the antiquity of the practices.

The interiors of the hourglass type of tubes and of many of the

conoidal pipes are so alike in their narrow neck or point of contraction about their centers as to suggest the likelihood of the plant smoked causing the fire to fall into the smoker's mouth, especially when it is considered that the tube almost of necessity had to be held perpendicularly in smoking.

Fig. 40, said to come from a mound near Ashland, Kentucky, belongs to the typical tubular hourglass type. It is now in the collection of Mr. A. E. Douglass, of New York City. It is 9 inches long, the bowl outside being 1¾ inches wide. It must be admitted that this pipe, from an artistic point of view, evidences a step in advance in ornamentation beyond anything heretofore observed in connection with American stone tubes of any kind. Upon this tube we see a wood duck facing the stem, which is well modeled and shows distinctly the bird's crest and two depressions for the eyes, which there can be little doubt were intended for the insertion of artificial eyeballs. The wings of the bird are crossed over the back, and its tail is so modeled as to represent a frog facing the bowl, the bird's legs answering for those of the frog. This singular composite figure, it must be admitted, is a most remarkable occurrence if it belongs to pure savage art, which the writer believes to be an impossibility. From the base of the tube to the top of the duck's head the measurement is 4 inches, the band being three-fourths of an inch in width. The bowl of this tube, which is behind the duck, has an opening 1¼ inches across and a depth of 1¾ inches, at which point it contracts to a tube one-half an inch in diameter, which for a distance of 4 inches is of uniform size; then it begins to expand gradually until it reaches a diameter of 1 inch at the opposite end. Another tube of this type is referred to by Squier and Davis as being found in a mound near the Catawba River, Chester district, South Carolina, upon which a well carved owl is attached by the back, showing a bold and spirited piece of sculpture practically in the round.[1]

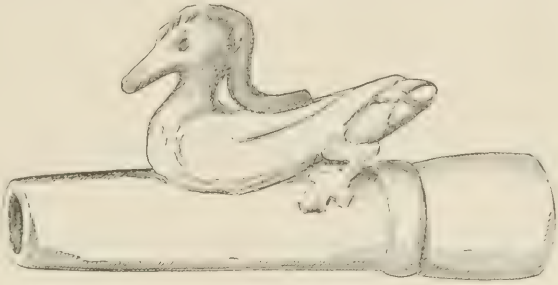

Fig. 40.

HOURGLASS TUBULAR PIPE.

Ashland (Kentucky) Mound.

American Museum of Natural History, New York. A. E. Douglass collection.

Thruston also figures a tube with a wood duck upon it, sitting quite at one end, and without an encircling band.[2]

The wood duck and owl are found constantly represented upon rectangular pipes in the territory of the tubes of hourglass form.

[1] Ancient Monuments of the Mississippi Valley, p. 226, fig. 123.

[2] Antiquities of Tennessee, p. 193, fig. 93.

Fig. 41 presents yet another peculiar divergence from the usual tubular pipe. This specimen is 9 inches long, the greatest diameter being $2\frac{3}{4}$ inches, and is from Williams Island, Tennessee, and was collected by Mr. J. B. Nicklin. The interior of the tube contracts and expands as does that of fig. 40. The bowl and stem are both enlarged by the usual longitudinal gouging. The opening at the smaller end of this tube is similar in character to that noticed in the stems of the California pipes, and appears to have been intended for the insertion of a stem of wood. Upon this tube lies stretched out the head and neck of a dog or wolf, fairly well modeled. On the sides of the bowl are rudely scratched into the serpentine, of which it is made, two totemic figures, one to the right and the other to the left of the animal's nose, so rudely executed that it is impossible to say for what they are intended, though one appears to represent the skin of some bird or animal. Between the ears of the animal are observable a series of parallel scratches, apparently made with a file, though the rest of the implement presents no surface which could not be duplicated with stone tools. The design of this pipe is more artistic than most of the hand work of savages, though the totems lightly scratched into the surface appear to be the work of another school from that which carved the remainder, the one and the other differing radically in technique. The writer has detected upon the surface of a number of the stone pipes in the collections of the U. S. National Museum totemic characters etched into the stone with some sharp-pointed tool, and they are invariably extremely rude efforts to represent some animal or object; so rude are these etchings that they arouse a grave doubt in the writer's mind as to whether they could have been made by a people who were capable of delineating animal form with the skill shown in the sculpture of many of the American pipes. Even though it be admitted that there were skilled artisans who made the pipes, and that the slight surface etchings were individual totems or marks, the suspicion remains that the sharp parallel, equidistant, straight lines so common on all sculptured or carved pipes are evidences of the use of the file of the white man.

Fig. 41.

TUBULAR STONE PIPE.

Williams Island, Tennessee.

Cat. No. 1017, U.S.N.M. Collected by J. B. Nicklin.

If aboriginal trade in stone implements made by the whites was of such value as to justify John Smith in asking permission of Powhatan to go through his country to obtain material from which to make axes, how much more valuable would be the trade in ornamented pipes; and can one doubt that the whites indulged in it extensively, unless it be

argued that the natives possessed superior capacity in manufacturing them? The characteristics of the etched totemic figures are not in accord with the pipe carvings. The one shows gross ignorance of outline, the other the skill of an artist. Bartram refers to "the skin of a wild-cat or young tiger laid at the king's feet with the great or royal pipe, beautifully adorned. The skin," he says, "is usually of the animals of the king's family or tribe, as the wild cat, otter, or bear, rattlesnake, etc."[1]

The last pipe referred to is related to a well-defined type of rectangular pipes, which, except that they are found too far to the south, would well answer to a description of the pipes to which John Smith referred as being "three-quarters of a yard long, prettily carved with a bird, a bear, a deer, or some such device at the great end," and "sufficient to beat out the brains of a man."[2] Strachey refers to them as being sufficient to beat out the "braynes of a horse."[3] Bagnall, Powell, and Todkill increase the length of this pipe to 3 feet.[4]

EARLY REFERENCES TO THE USE OF TOBACCO.

Prescott says, "Tobacco was among the products of Peru, yet the Peruvians differed from every other nation to whom it was known, by using it only for medicinal purposes in the form of snuff."[5]

The Inca Garcillasco de la Vega does not appear to refer to smoking, but only to the using of snuff.[6]

"Tabaco," according to Oviedo, "was a certain instrument of wood or cane made in the manner of the Greek γ, of which the Indians accommodate the two upper canes to the openings of the nose for the inhaling of the smoke of a plant which they call Cohiba or Cojiba," which is also called to-day by the name of that instrument.[7]

He, like others, says their "fumigation" was for the purpose of getting intoxicated.

Dr. A. Ernst concludes, after a most careful consideration of the text, that Oviedo never saw an Indian using the little implement he describes, and shows that "taboca" is the correct name for an implement which is still used by several tribes in South America. It is made of one of the long bones of the tapir, through which the Muras and Mauhés of the Amazon reciprocally blow into each other's nostrils the parica. Another explanation agrees with Las Casas; that

[1] William Bartram, Travels through North and South Carolina, Georgia, East and West Florida, Dublin, 1793.

[2] Captain John Smith in Virginia, p. 54, in Arber's edition of Smith's Works.

[3] William Strachey, Historie of Travaille into Virginia, 1612, p. 40 (Hakluyt Society).

[4] W. Simmonds, The Discoveries and Accidents with the First Supply in Virginia, 1612–1624, in Arber's edition of Smith's Works.

[5] History of Conquest of Peru, I, p. 140, Philadelphia, 1860.

[6] The Royal Commentaries of Peru, p. 120, London, 1618.

[7] Oviedo, Historie General e Natural de las Indias, I, plate I, fig. 7, Madrid, 1855, from Salamanca edtion of 1535–1547.

"cahoba" was the name, not only of the powder, but also of the ceremony of taking the powder.[1]

According to Fairholt, this figure of the pipe does not occur in the earlier editions of Oviedo, the cut being copied from the Salamanca edition of 1547.[2]

Purchas, about 1626, quaintly describes this tube referred to by Oviedo; alluding to the natives of Hispaniola, who, he says, "had tobacco in religious estimation, not only for a sanity, but for sanctity also, as Oviedo writeth, the smoke whereof they took into the nose with a forked pipe fitted to both nostrils, holding the single end in the smoke of that herb burning in the fire until they became senseless. Their priests most used this, who, coming to themselves after this sleepy fume, delivered the oracles of their zemes or devils, which sometimes spake by them."[3]

Dr. Max Uhle, of the Museum of Science and Art of the University of Pennsylvania, has written a most interesting paper on snuffing tubes,[4] and to him my thanks are due for the illustration shown in fig. 2.

Lafitau, speaking of this habit, says that "after they tumble down, deprived of all feeling, they are carried away in their hammocks by their wives."[5]

Southey refers to certain tribes of the Rio Negro "who have an extraordinary and tremendous ceremony, for which a large house is set apart in all their villages. It begins by a general flogging of one another with a thong and stone at the end. This continues eight days, during which the old women, who among the American savages officiate at most works of abomination, roast the fruit of the parica tree and reduce it to a fine powder. The parties who had been paired in the previous discipline are partners also in the following part, each in turn blowing this powder with great force through a hollow cane into the nostrils of his friend. They then commence drinking and the effect of the drink and the deleterious powder is such that most of them lose their senses for a time and many lose their lives. The ceremony lasts sixteen days, and is called the feast of the parica."[6]

Condamine, according to McCulloh, says the Omaguas, on the upper waters of the Amazon, snuff up a powder, which they call there "carrupa," by means of a forked hollow stick, the forked end being inserted in the nostrils. He says that the intoxication which follows this practice lasts twenty-four hours.[7]

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[1] A. Ernst, of Caracas, Venezuela, Etymology of the word tobacco. American Anthropologist, II, p. 134.

[2] F. W. Fairholt, Tobacco and Its Associations, p. 14, London, 1859.

[3] Purchas, His Pilgrimage, V, p. 957, London, 1626.

[4] Bulletin No. 4, University of Pennsylvania, I.

[5] Père Lafitau, Moeurs des Sauvages Amériquains, comparées aux Moeurs des premiers Temps, II, p. 138, Paris, 1724, quoting Oviedo.

[6] Robert Southey, History of Brazil, Pt. 3, p. 723, London, 1819.

[7] J. H. McCulloh, Researches, p. 93, Baltimore, 1829, quoting Pinkerton's Voyages, IV, p. 226.

Humboldt refers to the same habit among the Otomacs, whom, he says, "gather the long pods of a mimosacea, cut them in pieces, moisten them, and cause them to ferment, mixed with the flour of cassava and lime, procured from the shell of a helix. The whole mass is exposed to a brisk fire. When it is to be used, it is reduced to a very fine powder and placed in a dish: he holds the dish in his right hand and inhales the *niopo* by the nose, through a forked bone of a bird, the two extremities of which are applied to the nostrils. This bone, without which the Otomac believes he could not take this kind of snuff, is 7 inches long. It appeared to me to be the leg bone of a large sort of a plover. Father Gumilla says 'this diabolical powder of the Otomacs, furnished by an arborescent tobacco plant (*Orinoco illus.*), intoxicates them by the nostrils: deprives them of reason, and renders them furious in battle.'"[1]

Nadaillac says, "Another Spanish historian tells us that the natives of Hispaniola, to the great astonishment of the Spanish, placed a tube with two openings in their nose, in order to lose none of the aroma of the precious plant."[2] He further informs us, quoting Clavigero, who lived in Mexico in 1775, "that the Aztecs gave to tobacco the name 'pycietl,' which they were not satisfied to smoke in the shape of cigarettes wrapped in corn leaves, but also inserted it in fine powder in their noses. The powder thus employed served to clear the head, and its virtue was so highly appreciated in Spain that it was called the 'sacred herb.'"[3]

Herrera says of the Venezuelans, "They also use much tobacco for rheumatism, humors, and pains in the head. They take it through the nose mashed into powder: they drink the juice, and it makes a purge; and it is also used by the Spaniards."[4]

These references make it conclusive that the Y-like implement referred to by Oviedo is identical with the bifurcated bird bone referred to by Baron Humboldt, or the bone of a tapir as suggested by Dr. Ernst, the only one known to the writer, is in the Museum of the University of Pennsylvania, made from the leg bone of a llama. The evidence, however, appears plain that Oviedo made no mistake in attributing to the tube the properties of a pipe, a view fully sustained by Monardes.

The habit of using snuff appears to have been one of the peculiarities of the people of South America, who, so far as available writings indicate, did not smoke the pipe: and it is extremely doubtful if they smoked at all until the practice was introduced about the time of the Conquest of Mexico by the Spanish; nor does the smoking habit

[1] Alexander Humboldt and Aime Bonpland, Personal Narrative, 1799 to 1801, V, Pt. 2, p. 662.

[2] Nadaillac, Les Pipes et le Tabac; Matériaux pour l' Histoire Primitive et Naturelle de l' homme, November, 1885, p. 498, quoting Istoria antica del Mexico Césene, 1780 to 1781, VII.

[3] Idem, p. 498.

[4] Herrera, Historia General, p. 139, Madrid, 1726.

appear to have prevailed in the northwestern part of North America from any very early period, but seems to have been introduced from Japan by way of Siberia. if we may judge from the form of the pipes. How and where the smoking habit originated must remain largely a matter of conjecture. The effect on the system of tobacco smoking is sedative as well as stimulating, and the belief in its supposed medicinal properties is yet by no means obsolete either among the Indians or the whites. As McCulloh tersely remarks, "smoking among the rude Indians of North America became the pledge of their hospitality, like the salt of the Arab."[1] The use of tobacco and other plants, smoked in tubes or pipes, on the northern continent is most intimately associated with the life history of the Indian, not only as a sovereign remedy for most human ailments, but as a necessary function in all ceremonies, whether of the individual, of the clan, the tribe, or the confederacy. The hunter smoked to bring him game, the traveler to bring him a successful end to his journey, those on the water offered tobacco to the water to quiet the waves, or, if on land, to propitiate the winds which were the living evidences of good or evil creatures, and the smoking of the pipe throughout the whole of what is now the territory of the United States became something more than a flag of truce, for it was an evidence of friendship and its smoke the symbol of the spirit world. The practice of chewing tobacco was first noticed on the coast of South America by the Spaniards in 1502,[2] but does not appear to have been indulged in to any general extent elsewhere among the natives.

There appears to be no positive evidence of the extent to which the early Spanish settlers cultivated the tobacco plant, but that their first plantations were largely devoted to its growth there is no doubt.

Cigarettes and cigars among the Spanish-American peoples are employed almost to the exclusion of the pipe, and it may well be that such was the custom of those countries occupied by them from a time antedating the Spanish invasion.

As late as 1731 John Cockburn says that throughout New Spain there was "no such thing as a tobacco pipe, but poor awkward tools used by negroes and Indians."[3]

Wherever we find the tobacco plant mentioned in early chronicles it is invariably spoken of as possessed of remarkable medicinal properties, and this view of it was indorsed as late as the first half of the seventeenth century by the medical fraternity of the whole of Europe.

The Inca Garcillasso de la Vega (1688) says: "The herb or plant which the Spaniards call tobacco and the Indians sayri is of admirable use in many diseases amongst them; particularly being taken at the

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[1] J. H. McCulloh, Researches, p. 92, Baltimore, 1829.

[2] Encyclopædia Britannica.

[3] A Journey Overland from the Gulf of Honduras to the South Sea, performed by John Cockburn and five other English Gentlemen, p. 139, London, 1735.

nostrils in snuff serves to purge the head, and the other virtues of it are well known and esteemed in Spain, so that they give it the name of *Yerba Sancta*,"[1] or Herbe Sainte, according to Labat.[2]

Herrera refers to tobacco in Peru as a medicinal herb called picietl, "which stops pains brought on by colds, and taken in the form of a smoke is a cure for rheumatism, asthma, and colds, and the Indians and negroes carry it in their mouths, which makes them sleep, and so that they will not feel fatigued."[3]

Ulloa says that in the early part of the last century Lima's commerce consisted largely of snuff. "The merchants dealing in it sell only perfumes, such as amber, musk," etc.[4]

Dr. von Ihering doubts that the Chileans knew of tobacco and smoked the same out of pipes before the arrival of the Spanish; though we are told that in each temple there are two figures in relief, or two statues with black beaks, before which they continually burn the wood of certain trees of the country which have a very sweet odor.[5]

It is undoubted that, although the smell of burning tobacco is objectionable to many people, there are others who find it most agreeable, the matter being to a great extent one of education.

Thomas Man, an Englishman, in 1602, called the plant tobacco, though Dr. Monardes, a Spanish writer, employed the term as early as 1571. The French, as early as their first voyage to Montreal (about 1650), called tobacco petun, a term by which they referred to it for a long period. The word is sometimes spelled petum. Petun was, according to Fairholt, the word used by De Bry and "Herbe La Reine" was employed by Jean Neander, of Leyden, as also by Herba Legati.[6] Romano Pane, a Spanish priest, sent back by Columbus during his second voyage to Hispaniola, in De Insularum Ritibus (1497), speaks of a medicinal and religious plant, an herba inebrians, cohoba, cohobba, or giva. By whatever terms tobacco has been called, the words "tobacco" and "petun" are the two from which all other languages appear to have selected the name for this plant.

Knevet, about 1593, speaks of the natives of the West Indies as "mighty takers of tobacco," and think it not only the best thing their country produces, but one of the greatest necessaries of life; for besides its use in smoking and chewing they practice all their chirurgery with it and apply that alone in case of any hurt whatever.[7]

[1] Garcillasso de la Vega, The Royal Commentaries of Peru, p. 47, London, 1688.

[2] Labat, Nouveau Voyage aux Isles de l'Amérique, IV, p. 478, Hague, 1724.

[3] Historia General, p. 212, Madrid.

[4] Antonio de Ulloa, Voyage Historique de l'Amérique Méridionale, Book I, Chap. X, p. 490; and Don George Juan, A Voyage to South America, London, 1772, Book II, Chap. X, p. 109.

[5] Histoire de la Decouverte et de la Conquête de Pérou, p. 15, Paris, 1830.

[6] William Bragge, Bibliotheca Nicotiana. See also De Herba Panacea, Birmingham, 1880; Neander, Tobacologia, Hoogenhayan, 1644, pp. 18, 103, 122, 137.

[7] John Harris, Knevet's descriptions of the natives of the West Indies, Voyages and Travels, I, p. 706, London, 1705.

All available evidence tends to contradict the supposition that the peoples of the West Indies or of South and Central America possessed pipes, and the excavations among the graves and ruins of these peoples, which have been quite extensive, have not disclosed a single specimen so far as the writer has been able to discover. In the U. S. National Museum there are wonderfully rich collections of pottery and stone implements from Porto Rico, the Bahama Islands, Nicaragua, Costa Rica, and Chiriqui, yet none of them contain a single article which resembles a pipe of any form.

Conventional forms appear to govern the shapes of pipes in contiguous territory through the whole northern continent, the tubular shape, as before observed, being the only exception to the rule. The geographical distribution of the best-known types of pipes is so pronounced that a specimen of any one of them may be assigned to its proper area with little risk of mistake.

The curing of tobacco appears seldom to have been referred to by early writers, though Benzoni, according to H. Ling Roth, says: "When the leaves are in season they pick them, tie them up in bundles and suspend them near the fireplace until they are very dry, and when they wish to use them they take a leaf of their grain (maize) and putting one of the others into it they roll them round tight together; then they set fire to one end and putting the other into the mouth they draw their breath up through it and they retain it as long as they can, * * * and so much do they fill themselves with this cruel smoke that they lose their reason; and some there are who take so much of it that they fall down as if they were dead and remain the greater part of the day or night stupefied."[1] The curing here described is not dissimilar to the present approved method among tobacco cultivators.

The Mexicans, in sending ambassadors, according to all of the Spanish writers of the sixteenth century, exhibit a custom strikingly like those of the northern Indians in similar ceremonies. De Solis says: "In the right hand they bore a large arrow with the feathers up on high, and on the left arm a target made of shell. The intent of the embassy was known by the feathers of the arrow, for the red denoted war and the white denoted peace."[2]

Prescott says that "tobacco (in Mexican yetl), is derived from a Haytien word, 'tabaco.'"[3] There is too little known of how far the Mexicans used tobacco for the assertion to be made that it "did not possess the peculiar character attached to it by the North American Indians as an indispensable accessory to treaties, the cementing of friendships, etc., but was indulged in chiefly by the sick as a pastime and for its stimulating effect, and after dinner in the form of paper, reed, or maize-leaf

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[1] H. Ling Roth, The Aborigines of Hispaniola, Journal of the Anthropological Institute of Great Britain and Ireland, XVI, p. 259.

[2] Thomas Townsend, History of the Conquest of Mexico, quoting Antonio de Solis (1610–1686), p. 133, London, 1724.

[3] Conquest of Mexico, I, p. 154, note.

cigarettes called pocyetl, smoking tobacco, or acayetl, tobacco reed, the leaf being well mixed in a paste, etc."[1]

The habit of smoking was not sufficiently well known to Europeans to be described by any uniform formula, tobacco itself being called by many names and the pipe having as many more. The practice was, however, apparently a common one, employed by the medicine man to draw out or drive in pain. It may be said that for a century after its introduction into Europe physicians prescribed it in a manner as foolishly as did the Indians, for it was considered a specific for every known disease. The effect produced on the individual by smoking was to stupefy or intoxicate to the point of insensibility, which was astonishing to the Spanish: yet the Indian of the northwest still employs the pipe and tobacco in much the same way as did the natives who were first encountered by the Spanish invaders.

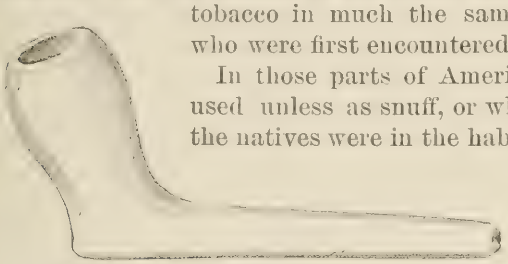

Fig. 42.

MEXICAN POTTERY PIPE.

Valley of Mexico.

Cat. No. 27889, U.S.N.M. Collected by Museo Nacional, Mexico.

In those parts of America where tobacco was not used unless as snuff, or where the pipe did not occur, the natives were in the habit of chewing maize or some other starchy substance and making of it an intoxicating drink; and in certain portions of South America they use cocoa or other means to produce intoxication or stupefaction. Diaz says: "The city of Cholula had an excellent manufacture of earthenware of three colors, red, black, and white, painted in different patterns, with which Mexico and all the neighboring countries were supplied, as Castile is by those of Talavera and Plascencia."[2] If pipes were made of pottery at that time specimens should be numerous, but the museum of the city of Mexico is said to contain not over half a dozen pipes having bowls to them; and it may be added regarding these that little can be said with certainty concerning their age or those who made them.

Fig. 42 belongs to a type which, though in some of its features resembles the modern pipe, is in others peculiar to Mexico. It is a glossy light-red pottery from the valley of Mexico, collected by the Museo Nacional, Mexico, and contains a tempering of fine sand. It is 6 inches long and 2½ inches high, being perfectly flat on the base, which is sufficiently broad to support it in an upright position upon any smooth surface, the bowl standing at an angle of about 15 degrees from the perpendicular. The interior diameter of the bowl at the top is three-fourths of an inch, which enlarges to seven-eighths of an inch at a point corresponding to the greatest exterior diameter; the base of the bowl

[1] Cyrus Thomas, Mound Explorations, Twelfth Annual Report of the Bureau of Ethnology, p. 687, quoting Bancroft's Native Races, II, p. 287.

[2] Diaz, True History of the Conquest of Mexico, p. 124, London, 1800.

contracts inside to half an inch, the stem-hole being of one-fourth inch uniform diameter. The gloss of these pipes is superior to any which the writer has seen on pottery of any character from primitive Mexican ruins or elsewhere. The surface, while smoothed as though with a burnishing tool, gives the writer the impression that prior to finishing the pipe its surface had been gone over with a scraping or cutting tool, as it is covered with innumerable narrow facets under the glaze, indicating rather a higher state of art than that evidenced in pre-Cortesian Mexican ruins.

There is in the Douglass collection one of these pipes, the bowl of which is white, the stem being pink, the colors gradually blending. It was found at Palenque, and is similar in shape to the pipe here figured, even to the glaze. A pipe of pottery in the same collection, which is said to have been found at Chatahoochee, Georgia, has a very similar form to the Mexican, though the base is not quite so flat.

Fig. 43 is another clay pipe from the valley of Mexico, collected by W. Batchelor, and of the same length and type as that shown in the preceding figure. It is of a raw-sienna color, having a bluish tinge; the walls of the bowl, fig. 42, are, however, thicker, and the stem, also flat on the bottom, broadens toward the end to a width of $1\frac{5}{8}$ inches. The surface of this pipe is also glazed, and upon its upper side a rude ornamentation has been incised, subsequent to the firing. The pipe looks as though it was intended to represent a duck's head and bill. The eyes consist each of a central dot, surrounded by two concentric circles, the outside one being $1\frac{1}{8}$ inches in diameter, while upon the stem, on each side, are two parallel lines following the contour of its outline to a point where they join, an incision beginning on each side of the stem hole, and running parallel to each other for an inch or more, when they curve inward and meet. The circles, measured by means of dividers, appear to be equidistant from the central dot of the eye, though in a similar specimen in the Douglass collection the rings appear slightly elliptical.

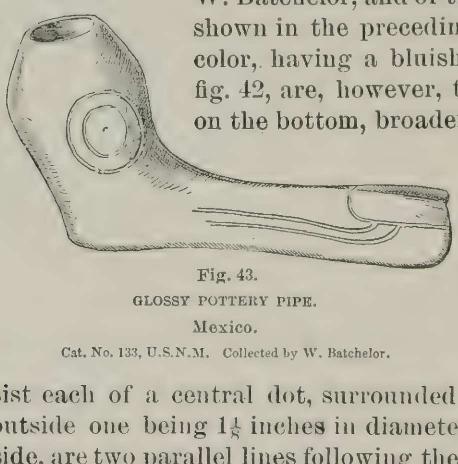
Fig. 43.
GLOSSY POTTERY PIPE.
Mexico.
Cat. No. 133, U.S.N.M. Collected by W. Batchelor.

Professor Holmes refers to a pipe preserved in the Mexican National Museum, the bowl of which is in the shape of the head[1] of a creature, whether quadruped or reptile it is impossible to say. The opening in the bowl corresponding to the jaws has both below and above a circle which appears to represent an eye, which, if they be intended for eyes, the head is doubtless that of a snake, a common figure upon American pipes. While the writer is inclined to see in the finish of these pipes

[1] Transactions of the Anthropological Society of Washington, D. C., 1883 to 1885, p. 80, fig. 13.

foreign influences, it must be admitted that his knowledge of Mexican pottery is not sufficient for him to be at all positive. The enlargement of the outside of the bowl is peculiar among American pipes to the Mexican ware, though almost identically the same shape, but of a smaller size, is common among the early English trade pipes.

A pipe apparently intended to represent the head and ears of some quadruped (fig. 44), made of hard burned pottery, was collected by Dr. J. W. Fewkes at the Pueblo of Santa Clara, New Mexico. In height and length it is 2½ inches by 2 inches. The outside of the bowl has a slightly raised rim, in which there are several notches cut through the surface, whether for ornament or as a tally it is impossible to say. This specimen in some of its features is similar to pipes found elsewhere, though the writer is inclined to attribute it to no distant period. Pipes of the type of fig. 43 are referred to as being found at Palenque, one of which has been figured in the great work of Kingsborough.

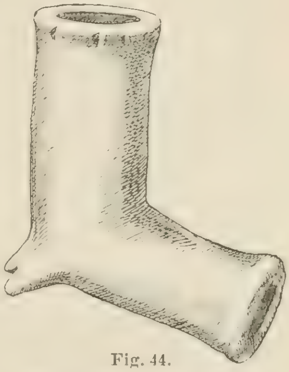

Fig. 44.

HARD-BURNED POTTERY PIPE.

Santa Clara, New Mexico.

Cat. No. 176396, U.S.N.M. Collected by Dr. J. Walter Fewkes.

There is in the Douglass collection a unique pendant of serpentine of a green color found in a mound on Indian River, Florida, very similar in its outline to the Mexican pipestems which are shaped like a duck's head. It has been suggested to the writer that the facets upon the Mexican pipes with glossy surfaces are indicia of the use of the burnishing tool rather than of scraping or cutting implements. While this view may be correct the question would be solved were it known whether the facets were made before or after the polishing.

In discussing references to the use of tobacco among the natives of Mexico and the West Indies it will probably be best to include those countries which first fell under early Spanish influences, comprising the coast of California, and, in a measure, that of Florida, before investigating conditions to the northward.

Friar Marco de Niça, in his journey to Cibola the year preceding the expedition of Vasquez de Coronado (1539), does not refer to the natives being addicted to smoking or using the pipe, though they were familiar, probably, both with the cigarette and the tubular pipe. This, however, it must be remembered, was considered not only by the Spanish but later by certain of the French as an idolatrous practice.

Alarcon in 1540 speaks of the natives having "physicians who cure them with charms and blowings which they make."[1] This there is little doubt was a reference to the tubular fire cure elsewhere more minutely described.

[1]Hernando Alarcon, Hakluyt's Voyages, III, p. 514, London, 1810, from edition of 1600.

As late as 1766 the natives of California were said to be "entirely ignorant of the effects of strong drink, and even if they do become drunk during the feast it is only done with the smoke of wild tobacco." which the author calls "Cimmaron,"[1] which plant, under the name of "Cimeron" (*Nicotiana attenuata*), De Paw asserts was used not only by the Californians, but by all the Western Indians.[2]

Venegas observes that they "use no intoxicating liquors among them, and it is only on their festivals that they intoxicate themselves with the smoke of wild tobacco."[3]

The Californians are also said never to have thought of making use of potters' clay for making cups, pots, bowls, etc., by hardening in the sun or by fire until taught by the whites.[4]

In this respect they would appear to differ from the natives of the greater part of the continent, but that it is a fact appears to be demonstrated by the excavations of Yarrow and Schumacher made in 1874; though it should be remembered that the Californians possessed a good supply of steatite from which they made "ollas" (bowls) and dishes. The veins of steatite or soapstone appear to have been worked in many parts of the continent, where suitable material was available for making bowls and dishes from a very ancient period; and in those sections of the country abounding in soapstone pottery is less abundant, though its scarcity, especially in the Atlantic States, extends but few miles from the quarries.

The Californians are also said to have burned the abalone shell for the lime to mix with tobacco to make them drunk.[5]

The writer is informed by Maj. J. W. Powell that the Piemas. Maricopas, Mojave, and Southern Utes smoke the leaves of the manzanita (*Arctostaphylos glauca*) and the Jamestown weed (*Datura stramonium*), the latter for the purpose of inducing a form of intoxication; at times they also chewed it for the same purpose. The Assiniboines smoke the leaves of the bear berry (*Arctostaphylos uva-ursi*) mixed with tobacco. In Alaska "the economical Indian usually cuts up a little birch wood or the inner bark of the poplar and mixes it with his tobacco."[6]

Alvar Nunez Cabeca de Vaca, who was, as he informs us, treasurer and alguazil major of the expedition of Pamphilo Narvaez in 1527, whose expedition was to conquer and govern the provinces toward the river of palms, was, with Castillo, Dorantes, and a negro, Estavanicó, the only survivors who returned to civilization. These four men were for years prisoners among the natives, but finally escaped, and after

[1] Historie de la Californie, I, p. 90, 1766, translated from English.

[2] Cornelius De Paw, Recherches Philosophique sur les Americains, I, p. 205, Paris, 1771.

[3] A Natural and Civil History of California, I, p. 68, translated from Spanish, 1758.

[4] History of California, I, p. 78, London, 1759.

[5] Tylor, California Farmer, April 27, 1860; H. H. Bancroft, Native Races of Pacific States of North America.

[6] W. H. Dall, Alaska and its Resources, p. 81, Boston, 1870.

years of wandering through the wilderness rejoined the Spanish in New Mexico, where the relation of their really wonderful adventures caused great astonishment. Cabeca de Vaca, among the Indians "became a pedlar," and was sent by his savage masters from "place to place looking for what they wanted." "My principal articles of commerce were," he says, "sea shells, with which they cut a kind of fruit like a bean which they use as a medicine, and little sea shells which are used as money. I brought back in exchange skins, and a kind of red earth used in coloring the skin and hair; stones for arrow points, very hard reeds for making them, glue, and scarlet colored hoops made of hair."[1] What he says of smoking is quite unsatisfactory, as his only reference appears to be that "in this country they stupefy themselves with a smoke which they buy at any price."[2]

Ferdinand de Soto, in 1539, entered Florida on the west coast, and, crossing the Alabama, Tombigbee, and Black Warrior rivers, reached the Mississippi north of the Arkansas, though he does not appear to refer to the smoking habit. The inference drawn is negative, it is true, but had the natives smoked to the extent which they did a hundred years later all over the contiment it can hardly be supposed that there would not have been reference to it.

Discoveries are constantly being made in Indian burial places of articles of European manufacture lying beside objects of the pure stone age, consequently there is great uncertainty in establishing the date of a burial. Many of the Florida mounds evidence apparent great age, and on the other hand many appear to be quite modern and to have been erected since the end of the first half of the seventeenth century. Professor Putnam instances the case of a burial mound in a group of mounds in Orange County, Florida, where "a number of ornaments made of silver, copper, and brass were found, also glass beads and iron implements which were associated with pottery and stone implements of native make."[4]

The Floridians in 1564 were said by Sir John Hawkins to have used in traveling a dried herb, which, with a cane and an earthen cup in the end, they "with fire and the dry herbs put together do suck through the cane the smoke thereof, which smoke satisfieth their hunger and therewith they live four or five days without meat or drink, and these all the Frenchmen used for this purpose."[5]

This reference precedes by twenty years the voyage of Ralph Lane, who is said first to have carried tobacco to England, and is the earliest reference which the writer has found in which the bowl is spoken of as distinct from the pipestem. Jean Ribault, in 1565, says "the natives

[1] Voyages relations, memoirs originaux, etc., de l'Amerique, p. 122, Paris, 1837, from Valadolid edition of 1555.

[2] Idem, p. 197.

[3] B. F. French, Historical Collections of Louisiana, quoting Biedma.

[4] Fourteenth Annual Report of the Peabody Museum, p. 17.

[5] Hakluyt's Voyages, p. 541, folio edition.

consider nothing more valuable than birds' feathers of different colors."[1] Yet neither he nor Laudoniere in 1564, in his second voyage, nor De Gourgues in 1567–68 appear to have referred to the pipe and tobacco being used in Florida. These travels have all been described with considerable minuteness, and had smoking been at that date a general habit there would surely have been reference to it. Professor Jeffries Wyman found no pipes in the shell heaps of the St. Johns River, Florida, and thinks "that had they been used by the builders of these heaps it is hardly possible, in the many excavations that have been made and the large facilities offered by the undermining action of the river, that some evidence of them should not have been detected."[2]

Mr. Frank Cushing, in the recent Florida excavations, where he made a remarkably rich find of aboriginal remains in stone, shell, wood, and pottery, speaks of its being noticeable that there was an absence of pipes.[3] On the other hand, Mr. Clarence B. Moore, who has made extensive investigations of the shell heaps of Florida, records that "at a depth of 6 feet from the surface of Mulberry Mound was discovered a pipe of earthenware complete in every part." He regards this as positive evidence that the people who built the shell heaps were familiar with the smoking habit.[4] Mr. Moore considered this mound among the later of the shell heaps.

A summary of evidence, therefore, appears to indicate that prior to the date of Alvarez and De Soto the smoking habit, if indulged in, was employed as a religious rite and not as a pastime, but subsequent to the Spanish settlements along the coast smoking became general. De Vaca refers to the shell heaps of the Gulf of Mexico, and says that the natives "subsist for three months on these shellfish and drink very bad water."[5]

Among the vast deposits of shells on the Chesapeake Bay shores in Maryland and Virginia, where thousands and tens of thousands of acres in the aggregate are covered with shell village sites, the pipe is almost the rarest object found. The shells of these heaps vary in depth up to 5 feet, yet the writer only knows of two primitive pipes ever being found, while the English trade pipe is not uncommon. These shell heaps would be occupied during the warmer months when conditions were such as to conceal a pipe dropped in the grass or underbrush, and one would suppose that they would be found as other objects are. The burial customs, however, of these Indians are little understood, and it is yet possible that an investigation of their graves when found may clear up our understanding of the subject. The writer inclines, there-

[1] Historical Collections of Louisiana, Pt. 3, p. 207, Memoir Historique des derniers Voyages aux Indes, Lieus Appelé La Florida (Nouvelle France).

[2] Jeffries Wyman, Fresh Water Shell Mounds of St. Johns River, Florida, p. 59, Salem, 1875.

[3] Letter from Tampa in Washington Post, February, 1896.

[4] Shell Heaps of the St. Johns River, Florida, American Naturalist, July, 1894, p. 623.

[5] Charles Rau, Prehistoric Fishing, p. 216, referring to De Vaca.

fore, to the belief that while smoking was probably indulged in, it was but to a limited extent until the whites, by the cultivation of tobacco, popularized its use.

That the natives of the shores of the great bays of the Atlantic coast were reasonably fair boatmen one would expect, but Bartram's assertion is almost incredible that they "have large handsome canoes, some of them commodious enough to hold twenty or thirty warriors. In these large canoes they descend the river on trading and hunting expeditions to the seacoast, neighboring islands, and keys, quite to the point of Florida, and sometimes across the Gulf, extending their navigations to the Bahama Islands and even to Cuba. A crew of these adventurers had just arrived, having returned from Cuba a few days before our arrival, with a cargo of liquors, coffee, sugar, and tobacco."[1]

The natives were great hunters and thoroughly acquainted with the natural food supply, in search of which they wandered great distances as it became seasonable in different places. As we are informed by Cabeça de Vaca, they have been known to travel hundreds of miles in a direct line from home for the purpose of hunting or of attacking some enemy. In their wanderings in search of food, upon their hunting expeditions, and upon the no less important search for suitable material for the manufacture of their implements they became thoroughly familiar with the minerals of the country, and with the artificial fracture of those minerals, which was often of greater importance to them than was the mineral itself, for to the Indian stone was valuable or the reverse according to the ease with which it could be chipped, pecked, cut, or ground. Pickett says: "Upon the creeks and rivers in Alabama, where they meander through the mountainous regions, are occasionally seen cuttings upon rocks, which have also been improperly attributed to European discoverers. In the country of Tallapoosa, not far below the mouth of the Sougohatchee and a few miles east of the Tallapoosa River, are cliffs of a singular kind of a gray rock, rather soft and having the appearance of containing silver ore. The face of these cliffs is very much disfigured by having round pieces taken out of them. The ancient Indians used to resort to this place to obtain materials for manufacturing pipes of large and small sizes and other household vessels. They cut out the pieces with flint rocks fixed in wooden handles. After working around as deep as they desired the piece was prized out of the rock. The author is also sustained in this position by unquestionable Indian testimony which has been procured by him."[2] He refers without doubt to a steatite or soapstone outcrop, a stone which has always been a favorite mineral from which to make pipes and bowls for cooking. In addition to its ability to resist heat, it was the most easily cut of all the minerals. What is said of Alabama would

[1] William Bartram, Travels through North and South Carolina, p. 225, Dublin, 1793.

[2] Albert James Pickett, A History of Alabama, and incidentally of Georgia and Mississippi, from the earliest period, I, p. 177, Charleston, 1851.

apply equally to every State certainly as far north as Connecticut. The steatite has been everywhere worked by natives to furnish culinary vessels, and we see that in this, as in all other stones, the native thoroughly appreciated the varying texture of minerals and selected only those best suited to his requirements. The advent of the white man caused an immediate revolution in aboriginal art. Wherever his wares were distributed, skins were traded for blankets, and, as Schoolcraft well says, "Europeans gave them iron and brass for the rude clay pots; steel for wooden traps; gunpowder, the rifle, and guns for bows and arrows; fire steels and flints for the painful process of percussion; the White Chapel for the bone needle; the steel awl for the *aishkun* or tip of the deer's horn, and, in fine, a style of arts so superior to all the aboriginal modes of meeting the common wants of life that the latter fell into disuse as soon as the European fabrics could be obtained."[1]

Think of the immeasurable superiority of a tool of iron or steel over the best and sharpest of those of stone. The one implement cut wood or soapstone where the other may be said only to have bruised it. The metal point, as a perforater or drill, and the rasp must have been very attractive tools to people who had theretofore known only the stone or wood drill-point used with sand, or the grinding stone. If we examine any collection of ancient American pipes the extreme care with which they have been finished is noticeable, though it is seldom that a polish of any kind is met with in any implements of aboriginal art north of Mexico. Compare, however, a general collection of stone implements and the difference of surface wear is noticeable, and we see that not only have rubbing stones varied according to the work required of them, but a strong suspicion is aroused that the sands and smoothing material were more highly appreciated than would be suspected by a casual observer. If one will use sand to smooth a stone surface he will quickly appreciate that sands vary enormously in their cutting properties. Pliny shows that this was appreciated in his day, for he discusses the relative merits of "the sand of Ethiopia" and "of India," while for polishing marble he discusses the properties of "Indian sand calcined," "the sand of Naxos," and that of Coptos, generally known as "Egyptian sand;" "and more recently," he says, "a stone has been discovered in a creek of the Adriatic Sea that is equally efficacious for this purpose. Thebaic stone is considered well adapted, as also porous stone, or pumice powdered fine."[2]

Fig. 45 is one of the earliest representations of the American pipe, showing a separate stem, drawn after an illustration of De Bry, in Brevis Narratio.[3] The woman is represented as furnishing the man

[1] North American Indian Tribes, Pt. 4, p. 142.

[2] The Natural History of Pliny, p. 326, translated by John Bostock and H. S. Riley, London, 1866, Bohn edition.

[3] Brevis Narratio, Book II, plate XX, Frankfort, 1591, published by Jacob Le Moyne.

with leaves from a bowl or basket of the period of Laudoniere's visit to that part of the territory then called Florida, which covered an indefinite geographical area. The author of Recherches Philosophiques des Americains refers to the custom of the Northern American Indians making the women and slaves that are to be sacrificed on the death of a chief take drugs. They use, he says, the leaves of tobacco broken and made into paste, of which they form large balls, that those who are to die are required to swallow. They make them drink a glass of water, which in dissolving throws them into a complete delerium.[1]

Bartram, setting out from Mobile in 1777 and arriving at Talusa, speaks of the houses of the people being "decorated with various paintings and sculptures, which I suppose to be hieroglyphic, and as an historical and legendary of political and sacerdotal affairs; but they are extremely picturesque, or caricature; as men in a variety of attitudes, some ludicrous enough, others having some kind of animal, as those of a duck, turkey, bear, fox, wolf, etc., and again, those kind of creatures as having the human head. These designs are not ill executed, the outlines bold, free, and well proportioned."[2]

Fig 45.
FLORIDIAN SMOKING.
After De Bry. Brevis Narratio.

It must be remembered that Bartram is speaking of a time two hundred and thirty years subsequent to the period when these Indians first had opportunity to become tolerably familiar with iron tools, though there yet remained even at that date much of primitive culture. The savage, made familiar with sharp cutting tools, quickly takes to carving as soon as some one suggests the idea of design. With these natives iron was quite a common possession at the period of Bartram's visit, and the churches of the French and Spanish had both familiarized the natives with the principles of carving. The French and Spanish of the period were well skilled carvers and carpenters, whom the Indians would not be slow to imitate. Though it is not intended to question the fact that rude carving may have been executed by some of the Atlantic coast Indians at an early period, it is suggested that there is little evidence that any of them carved in a manner to justify more being said of their work than that it was "not ill executed," the known antiquities of the Mexicans being superior examples of their date.

Verazzano, in his voyage along the coast of America in 1524, from the thirty-fourth degree of latitude to Newfoundland, probably refers to the use of the tobacco pipe in some form in his allusion to the natives who "live long and are seldom sick; and if they chance to fall sick at

[1] Recherches Philosophiques sur les Americains, II, p. 224, Paris, 1771.
[2] William Bartram, Travels through North and South Carolina, p. 454, Dublin, 1793.

any time they heal themselves with fire, without any physician. They say that they die for very age."[1] He nowhere speaks of tobacco or the pipe, unless it be in the above sentence, though stopping in many places.

Powell's map of the areas occupied by the different linguistic stocks of Indians at the time of the first advent of the whites shows that members of a given stock were often separated from each other by natives speaking dissimilar languages. The Sioux are found in North and South Carolina, the Algonquin along the Atlantic coast, while a tribe of the Iroquoian stock were located in Tennessee, each cut off by long distances from the main body speaking the language of their particular stock; and many other instances are noted on the same map. To carry history back only a few decades would doubtless materially change the geographical distribution of the tribes, due largely to the success or failure of their interminable internecine wars in which they were commonly engaged.

From the earliest period of white occupancy of Maryland and Virginia, tobacco constituted the great bulk of the exports of those colonies. The wonderful spread of its consumption during the first half of the seventeenth century created an enormous demand for the product, and the consequent inflation of its price was an inducement to the colonists to devote their greatest energies to its cultivation, to the exclusion of necessary vegetables and cereals, whereby on more than one occasion the population suffered from a scarcity of food. This plant consists of several species of *Nicotiana* (of the natural order of *Solanaceæ*), but those of which the leaves are used as a narcotic are few in comparison to the whole number.

The pipe of the Indians of New Sweden, otherwise Pennsylvania, described by Holm, appears to have had a stem equal in length to any on the continent. He says they "make tobacco pipes out of reeds about a man's length; the bowl is made of horn and to contain a great quantity of tobacco; they generally present these pipes to their good friends when they come to visit them at their houses and wish them to stay some time longer; then the friend can not go away without having a smoke out of the pipe. They make them of red, yellow, and blue clay, of which there is great quantity in the country; also of white, gray, green, brown, and black and blue stone, which are so soft that they can be cut with a knife; of these they make their pipes, a yard and a half long or longer."[2]

He further speaks of the natives having in their hands a tobacco pipe a fathom long. Holm's grandfather was a minister of the gospel, who accompanied Governor Printz as his chaplain in 1642; his father

[1] John de Verazzano, Hakluyt's Voyages, III, p. 362, London, 1810, reprint of 1600.

[2] Thomas Campanius Holm, A short Description of the Province of New Sweden, now called by the English Pennsylvania, in America, compiled from relations, etc., of persons of credit, p. 130, translated from Swedish by S. Du Ponceau, Philadelphia, 1834.

was in America about the same time. The length of this pipe and stem appears great in comparison with pipes with which we are familiar, though George Catlin represents a Chippewa Indian standing erect, leaning on a pipestem. It should be remembered, however, that some of Holm's assertions have been questioned, and are to be taken with grains of allowance, notably that reference to "a large and horrible serpent which is called a rattlesnake. It has a head like that of a dog and can bite off a man's leg as clear as it had been hewn down with an ax."[1] Though such snake stories are of course the exaggerations of ignorant people, it is the wonderful and mysterious which has greatest attraction for the multitude, and consequently such material will stray into print when histories are written by persons not themselves acquainted intimately with the country of which they write. The snake was a totem of many Indian tribes, if not of most of them, and is often represented coiled around the pipe bowls in graceful curves or lying along the stems, usually facing the smoker. Certain of the Pueblo Indians, the writer is informed, never kill snakes, even the deadly rattlers, because of their sacred character. When one is found in too close proximity to a camp, it is caught between the forks of a stick and carried to some secluded spot, where it is released. A similar veneration is said by the elder Pliny to have prevailed. "In Syria also," he says, "and especially along the banks of the Euphrates, the serpents never attack the Syrians when they are asleep; on this account they never kill them."[2]

Kalm, who was in New Sweden in 1749 at a place called Raccoon, on the Delaware River below Philadelphia, says "the natives had tobacco pipes of clay, manufactured by themselves, at the time the Swedes arrived here. * * * They did not always smoke true tobacco, but made use of another plant instead of it, which was unknown to the old Swedes, one of whom assured me it was not the common mullein, which is generally called Indian tobacco."[3]

Roger Williams says of the Narragansetts: "They generally all take tobacco; and it is commonly the only plant which men labor in, the women managing all the rest; they say they take tobacco for two causes; first, against the rheume, which causeth toothache, which they are impatient of; secondly, to revive and refresh them, they drinking nothing but water."[4]

This tobacco he calls "Wuttammâuog;" "that is a weak tobacco, which the men plant themselves very frequently; yet I never see any take so excessively as I have seen men in Europe; yet excess were more

[1]Thomas Campanius Holm, A short Description of the Province of New Sweden, p. 53.

[2]The Natural History of Pliny, II, p. 354, translated by John Bostock and H. S. Riley, London, 1866, Bohn edition.

[3]Peter Kalm, Travels into America, II, p. 117, London, 1771.

[4]Roger Williams, A Key into the Language of America, p. 43, London, 1643, in Narragansett Club publications, I, edited by J. Hammond Trumbull.

tolerable in them, because they want the refreshing of beer with which God hath vouchsafed Europe.[1] The men throughout the country have a tobacco bag, with a pipe in it, hanging at their back. Sometimes they make such great pipes, both of wood and stone, that are 2 foot long, with men or beasts carved so big or massive that a man may be hurt mortally by one of them; but these commonly come from the Mauquâuwogs (Mohawks), or the man-eaters, 300 or 400 miles from us. They have an excellent art to cast our pewter and brass into very neat and artificial pipes."[2] "Narragansett," says Wood, "was the storehouse of all such kinds of merchandise as is amongst the Indians of those parts. From hence other tribes have their great stone pipes, which will hold a quarter of an ounce of tobacco, which they make with steel drills and other instruments. Such is their ingenuity and dexterity that they can imitate the mold so accurately that were it not for matter and color it were hard to distinguish them. They make them of green and sometimes of black stone."[3]

In 1674 the Narragansetts are spoken of as having been a great people, whose sachem was about Cannonicut Island, and who "are now but few comparatively; all that people can not make above 1,000 men."[4] This tribe was probably one of those which suffered so severely during the first half of the seventeenth century from the ravages of an epidemic that is said to have carried off the inhabitants of whole villages. Williams gives the name of a pipe as "Wuttammagon—literally, a drink instrument," or "Hupuonck." In 1620 we are told that "Massassoyt," chief of the Wampanoags, was "a lusty man of middle age, of a grave, demure countenance and sparing of speech. He had a long knife hanging in a string at his bosom, and behind at his back a little pouch of tobacco. This was furniture he never was without. His men also had their bags of tobacco at their backs."[5]

Samuel G. Drake says of Massassoit that he "differed from the rest of his followers only in a great chain of white bone beads. About his neck hangs a little bag of tobacco, which he drank and gave us to drink."[6]

James Thatcher refers also in 1621 to Samoset having a wild-cat skin on one arm, coming with some of his companions to the town of Plymouth, and bringing with them some parched corn reduced to a fine powder called "nokehike," or "nocake," which they eat mixed with water, and "had a little tobacco in a bag, of which they drank frequently."[7]

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[1] Roger Williams, A Key into the Language of America, p. 73.

[2] Idem, p. 73.

[3] William Wood, New England's Prospect, Pt. 2, Chap. 3, 1639, quoted in Narragansett Club publications, I, p. 73, note.

[4] Massachusetts Historical Society, I, p. 148, referring to Gookin, 1674.

[5] John Harris, A Relation of the Plantation at Plymouth, Voyages and Travels, I, p. 853, London, 1705.

[6] Samuel G. Drake, History and Biography of the Indians, p. 86, Boston, 1851.

[7] James Thatcher, History of the Town of Plymouth, p. 34, Boston, 1835.

"The Literary Gazette, September 11, 1819, page 588, says the Turks use the phrase 'drinking tobacco.'

"In Webster's Dictionary one definition of 'to drink,' is 'to inhale, to smoke, as tobacco.'

"In Miseries of Enforced Marriage, V, page 6, by George Wilkins, 1607, appears the line 'Feed well, drink tobacco.'

"In the Roaring Girl, Middleton & Decker, 1611, one of the personages says of some tobacco, 'This will serve to drink in my chamber.'

"A reference in one of Donne's satires, I, page 87 (Donne flourished 1610–1620), is as follows:

> Till one which did excel
> Th' Indians in drinking his tobacco well.

"That actual swallowing of the smoke was the mode in England at the time mentioned is shown by several contemporary illustrations of customs where the pipe is in the mouth or hand and the smoke is issuing from the nostrils."[1]

The excesses to which Williams refers as existing in Europe in the use of tobacco must have prevailed to an inordinate degree in the plantations, for a statute was enacted in 1633 in that of Massachusetts which provided that there must be no idleness "under penalty," and especial reference was made to "common coasters, unprfitable fowlers, and tobacco takers."[2]

In the account of Frobisher's second voyage, about 1577, to the coast in the vicinity of Hudson Bay, there does not appear to be reference to pipes and tobacco, although the implements and clothes of the natives are referred to with some particularity.[3]

If at that period the natives of Hudson Bay had no tobacco, which, however, is at present uncertain, the first English traders would have lost no opportunity to popularize its use in their journeys to the far north, where they went in search of food-fishes, as they did into the interior in search of peltries. The earliest reference which the writer has found to smoking among the Hudson Bay people is that of Henry Ellis, who went in search of the Northwest passage in 1746–47, by which time the habit had become general. He says: "These people have a very extraordinary custom. It is that when the fathers and mothers can no longer support themselves with their own labor they require their children to strangle them; and according to them it is an act of obedience on the part of the children, who perform the act as follows: First they make a pit, which the old person enters; for some time they converse with their children, at times they smoke a pipe, take a drink, etc.

[1] Garrick Mallery, American Anthropologist, II, p. 141

[2] William B. Weedon, Economic and Social History of New England, 1620 to 1789, I, p. 83, Boston, 1891.

[3] Master Dionese Settle, Second Voyage of Martin Frobisher, Hakluyt's Voyages, III, London, 1810; reprint of 1600 edition.

They then say they are ready; then two of the children put a leather strap around the parent's neck, and standing opposite each other they pull with all their strength until the parent is dead. Those who have no children often beg their friends to do it for them, but often they do not accomplish their wish in this respect."[1]

Cartier, in his first voyage to the St. Lawrence in 1534, when he went as far as Saguenay, does not mention smoking, though he does the following year, when he reached Hochelega. With the exceptions noted the people of North America generally appear to have been familiar with the practice of smoking prior to the arrival of French, English, Dutch, or Swedes. How far their intercourse had extended with the Spanish there is a lack of testimony, though that there was an early knowledge of Spanish and English existence is possible, for the first travelers on the Mississippi heard from the natives of men who rode horses in the southwest, and of people who traded them guns along the eastern coast. The Indian wandered over immense distances, and Carver records, about 1768, that "the Winnebagos, from their inveterate hatred of the Spanish, informed me that they made many excursions to the southwest which took up several moons. An elderly chief told me that about forty-six winters ago (1722) he marched at the head of fifty warriors to the southwest for three moons and attacked the Spanish."[2]

The Gros Ventres of Minnesota "used to raise small quantities of tobacco, the leaf of which as obtained from them was considered of great value, and for which their fellow Indians paid large prices. Peace parties of the Knistenos and Ojibways often proceeded hundreds of miles chiefly for procuring their much-coveted tobacco leaf."[3]

The Senecas "used to smoke tobacco and the bark of the Wahoo" (euonomous), "called by them cannakanick. They often mixed it with tobacco; they also smoked the bark of a species of dogwood. We used to call it in Pennsylvania the arrowwood, from the shape of the sprouts."[4]

The word "kil' likinick" is extensively employed among the Western tribes to designate tobacco. It is from the Dakota tongue, meaning literally redwood, the substance generally employed by the Menomoni being the red osier (*Cornus stolonifera* Michaux.)

"Tobacco is frequently used by the Menomoni as an offering. It is placed upon grave boxes; sprinkled on stones or rocks of abnormal shapes, their form being attributed to the great deity."[5]

Among the Kickapoos, Kansas, and Osages sumac (*Rhus trilobata*)

[1] Henry Ellis. Voyage à la Baye de Hudson, p. 245, Leyden, 1750.

[2] Travels of Jonathan Carver, p. 22, Philadelphia, 1796.

[3] William W. Warren, Minnesota Historical Collections, V, p. 179.

[4] Baldwin, Western Reserve Historical Society, No. 50, p. 107.

[5] Walter J. Hoffman, Fourteenth Annual Report of the Bureau of American Ethnology, pp. 250, 252.

next to tobacco was considered "one of their most fashionable treats when mixed in about equal proportions."[1]

Hunter, who was thoroughly acquainted with the Indians, having been a prisoner among them for many years, shows, however, that the treatment of disease by fire was not always in conjunction with tobacco. "They sometimes," he says, "relieve inward pain by setting a piece of touchwood on fire and permitting it to produce a blister over the pained part, saying that such treatment draws the enemy from his lurking place and exposes him to direct attack."[2]

In 1823 the Omaha were said to "frequently eject the smoke through the nostrils and often inhale it into the lungs, from which it is gradually ejected again as they converse, or in expiration."[3]

Long says "the kinnicanick, or, as the Omahaw call it, ninnegahe, which they use for smoking in their pipes is composed partly of tobacco and partly of the leaves of the sumac (*Rhus glabra*), but many prefer to the latter ingredient the inner bark of the red willow (*Cornus cericea*), and when neither of the two latter can be obtained the bark of the arrowwood (*Viburnum*) is substituted for them. These two ingredients are well dried over a fire and comminuted together by friction between the hands."[4]

The writer is informed that the kinnikinik of the Indians of the southwestern portion of the United States, notably of the Cheyennes, Comanches, Arapahoes, Kiowas, and Sioux, consists of the inner bark of the sweet willow (*Salix nigra*), which being first dried and pulverized by rubbing between the hands is used with sumac (*Rhus trilobata*) leaves; at other times they use the sumac alone. The Rev. M. Eells refers to killikinick as the dried leaves of a small bush which grows a foot or two high, and of dried laurel (*Kalmia latifolia*); also the dried bark of ironwood (*Carpinus caroliniana*) is used when they are short of tobacco to mix with it, but it is seldom if ever used alone. Tobacco is obtained from the Americans.[5] In 1843, near Walla Walla, the Nez Percés called tobacco "smoke," and remarked "we are better than the white men, for they eat smoke; we do not eat smoke. Such is their attachment for this stupefying vegetable that to obtain it they will part with their last article of food or clothing, or even take down the poles which uphold their dwellings."[6] Marcy and McClellan

[1] John D. Hunter, Manners and Customs of Tribes West of the Mississippi, p. 390, Philadelphia, 1823.

[2] Idem, p. 398.

[3] Stephen H. Long, Expedition from Pittsburgh to the Rocky Mountains, I, p. 332, Philadelphia, 1823. See also Randolph B. Marcy and George B. McClellan, Exploration of the Red River of Louisiana in the year 1852, Washington, 1853.

[4] Idem, p. 331. See also Maximilian, Travels in the Interior of North America, p. 154, London, 1843.

[5] The Twana Indians, Bull. U. S. Geol. and Geog. Surv., 1877, III, p. 64.

[6] Samuel D. Parker, Journal of an Exploring Tour Beyond the Rocky Mountains, p. 291, Ithaca, New York, 1844.

say also that the Comanches were extravagantly fond of tobacco in 1852.[1]

The Rev. Père Morice says of the "Tsilkohtines des Rochers," the Dénés of the western Rocky Mountains in British Columbia, that their "pipe is of serpentine or other stone and is common to both sexes, for it must be remembered that among the savages the women are inveterate smokers."[2]

The Abanaqui of Maine, who are of Algonquin stock, still smoke the outer bark of the red osier (*Salix purpurea*), the bark of the pine tree, and both leaf and bark of the squaw bush (*Vaccinium stramenium*), and mix the musk of the muskrat with the tobacco to give it a flavor.

Du Pratz refers to "a bank in which there were veins of white earth. The clay was unctuous and fine, from which I have seen very pretty pottery made. In the same banks ocher is found, which the Natchez come to get to smear their pottery with. This pottery was very pretty. When so smeared with ocher it became red after being cooked."[3]

Some of the purest clay pipes found are from the Lower Mississippi. In the far North, Alexander Mackenzie, in 1789, made the Slave or Dog Rib Indians smoke, "though it was evident they did not know the use of tobacco."[4]

The natives of the lower part of the Mackenzie River saw the first whites in 1788. These were probably from the ships commanded by Captain Cook.[5]

Franklin calls attention to the fact that as late as 1827 the natives of Herschell Island, at the mouth of the Mackenzie, "used tobacco, and some of our visitors had smoked it, but thought the flavor very disagreeable."[6] He thought they had obtained it of the Russian traders.

The shape of the Eskimo pipe, as well as the diminutive size of its bowl, forcibly suggests that it is an importation into America from the continent of Asia, brought there likely by the Japanese whom the Russians appear to have brought to the continent.

Near Icy Cape, in latitude 70° 43″, longitude 159° 46′ west, in 1826, Beechy says he found tobacco the most merchantable article, though "one of the natives who came alongside in a caiak, having obtained

[1] Randolph B. Marcy and George B. McClellan, Exploration of the Red River of Louisiana, p. 102, Washington, 1853.

[2] Chez Les Sauvages aux Pays de l'Ours noir de la Colombe Britannique, p. 37, Paris, 1897.

[3] Le Page Du Pratz, Histoire De La Louisianne, I, p. 124, Paris, 1758.

[4] Alexander Mackenzie, Voyage from Montreal Through the Continent of North America, p. 31.

[5] Idem, p. 320.

[6] John Franklin, Narrative of the Second Expedition to the Polar Sea, p. 118, Philadelphia, 1828.

some tobacco that was offered for a lance, was resolute in not delivering up either."[1]

In latitude 48° as early as 1578, at a point approximately where the Aht and Chinook Indians are now located, on the Pacific Coast, the natives gave to Sir Francis Drake a little basket made of rushes and filled with an herb which they called "*Tabah*."[2]

At another point Drake refers to "tobah" being offered his people "for sacrifice upon their persuasion that we were gods."[3]

About latitude 38° to 40° on the Pacific Coast, as early as 1600, "divers pieces of earthenware pots, as finely made as those in Spain," are referred to by Francis Ulloa.[4]

The writer has endeavored to cite as far as possible all early references to smoking material and pipes from Spanish, French, English, Dutch, and Swedish sources, which relate to the Atlantic or Pacific coast as well as to the interior of the continent. While some writers are silent on the subject, those who do refer to the custom do so invariably in a manner to make it conclusive that the pipe and tobacco, or the plant smoked, was regarded as important in all serious functions as well as in many cases requiring medical treatment. To make the fire with which the pipe was lighted throughout the whole continent, the straight shaft revolved between the extended palms appears to have been commonly employed in the same manner as the natives of Australia are known to have used it from an early period. The Papagos of New Mexico as early as 1848 made fire by plowing, as the writer is informed by Gen. D. H. Rucker, who was well acquainted with these Indians. This process is performed by rubbing the point of one stick rapidly back and forth in the groove of another piece of wood.

Clavigero tells us the Mexicans made fire, as did the ancient shepherds of Europe, "by the friction of two pieces of wood."[5] As early as 1586 John Davis describes the making of fire in the extreme north of the continent by means of the strap drill,[6] though the knowledge of this drill had been obtained almost certainly from Europeans, the American Indian having before their acquaintance with the whites had no knowledge of the principle of such an implement.

The Virginia Indians in 1602 were said by Captain Gosnoll to make fire "with a flat piece of emery stone and sort of mineral which they can not tell us the name of, but they have a piece of dry touchwood ready which receives the spark they knock out between the other two."[7]

[1] F. W. Beechy, Narrative of a Voyage to the Pacific and Bering Strait, p. 308, London, 1831.

[2] A Voyage About the World, p. 119 (Hakluyt Society).

[3] Idem, p. 122.

[4] Hakluyt's Voyages, III, p. 476, London, 1810; reprint of 1600 edition.

[5] History of Mexico, II, p. 262, Philadelphia, 1817.

[6] John Harris, Second voyage of John Davis for the discovery of the Northwest passage, Voyages and Travels, I, p. 581, London, 1705.

[7] John Harris, Voyages to the Northern Part of Virginia by Captain Gosnoll, Voyages and Travels, I, p. 816, London, 1705.

The subject of primitive fire making has been exhaustively treated by Dr. Walter Hough, of Washington City.[1]

The size and shape of some pipes are more indicative of their owners' occupation than one at first glance would be inclined to suppose. Nomads or hunters, for example, without fixed dwelling places, would not employ the ponderous pipes often found along the shores of the Mississippi River and in the Southern States, weighing at times many pounds, and often carved in the form of some bird or animal. Unless carried by canoe they would constitute a serious problem in the movements of a family. There may also be a serious doubt whether the delicately made pottery pipes of the Southern States and the equally carefully shaped specimens from northern New York, showing at times a thin bird's bill 2 or 3 inches above the bowl, were not necessarily the property of people living in permanent habitations.

PIPE BOWLS WITHOUT STEMS.

There are many ways of accounting for the evolution of the tubular pipe into one of a rectangular shape. The smoking of the tube would undoubtedly be extremely awkward, and notwithstanding the pebble or pellet of pottery dropped into the bowl, the material smoked would escape into the smokers mouth while being held perpendicularly as though drinking, while an accidental or intentional curve would suggest a valuable improvement in shape.

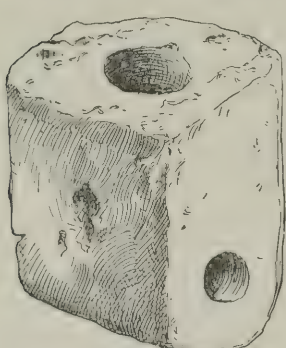

Fig. 46.
PIPE BOWL OF VOLCANIC TUFF.
Oregon.
Cat. No. 1282, U.S.N.M. Collected by T. Carver.

Mr. Clarence B. Moore found on the St. Johns River, Floridä, a tubular pipe slightly curved and made of pottery with the elliptical cross section, which shape may well have been caused in drying the clay before burning. There is a tubular pipe of steatite in the collection of the University of Pennsylvania curved slightly in its longitudinal section, as is the California specimen herein illustrated.

Having considered the tubular pipe, which consisted of a stem and bowl in the same plane, we shall next discuss those pipes consisting of a bowl alone, its walls being perforated for the insertion of a separate stem. Whether this pipe should come next in order is open to question. In this type ordinarily the stem hole is approximately one-third the greatest diameter of the bowl, though there are as a matter of course rare exceptions to the rule where these diameters differ.

Fig. 46 is of this type, yet it would readily pass for one of recent production. It was found in Oregon, collected by Mr. T. Carver; it is drilled from a cube of volcanic tuff, which to a casual observer might well pass

[1] Smithsonian Report, 1888, p. 531.

for an ordinary piece of building brick. In length it is $1\frac{1}{2}$ inches, in height $1\frac{7}{8}$ inches, and $1\frac{1}{4}$ inches wide. In this specimen, as is usual in pipes of this type, it is observed that both bowl and stem have been bored by means of a drill with a solid and not a tubular point, though it is often found that the bowl has been subsequently enlarged by scraping or gouging. These pipes were smoked with stems of wood, reed, or bone, governed by the supply of the locality.

Fig. 47.

STONE BOWL PIPE.

Berks County, Pennsylvania.

Cat. No. 6670, U.S.N.M. Collected by George M. Keim.

Of identical type is a pipe from Berks County, Pennsylvania, collected by Hon. George M. Keim, which is of a light brown talc. The block from which it (fig. 47) is made is rectangular at the base, about $2\frac{1}{2}$ inches in height, becoming cylindrical at the top of the bowl. This pipe is evidently in an unfinished condition, and therefore doubly interesting, as showing much of the process of work upon it. The whole surface is covered with narrow facets, showing the mark of the blade with which it was cut; the uniformity in their width and their unusual length demonstrates conclusively that the tool was of metal.

Above the stem hole a ridge has been left almost entirely encircling the bowl, sufficiently pronounced to show that it was intended as an ornament. At one point on this specimen are noticeable a number of equidistant straight lines, which appear to have been made with a metal file, and which are common on so many American pipes.

Fig. 48.

OVOID STONE BOWL.

Brownsville, Ohio.

Cat. No. 12494, U.S.N.M. Collected by W. Anderson.

A gray sandstone ovoid bowl (fig. 48) from Brownsville, Ohio, collected by Mr. W. Anderson, is slightly broken around the top; the rest of the exterior surface, however, is perfectly smooth and without ornamentation. This bowl has been ground into shape, the cavities being made by means of solid drill points. It is of symmetrical ovoid form, the base being flattened, and the thickness of the walls is scarcely one-eighth of an inch.

The bowl of fig. 49 is ground similar to that of the preceding specimen and is about the same height, $1\frac{3}{4}$ inches. It is made from an indurated clay of a grayish color. The stem hole has been bored by means of a large drill, and is half an inch in diameter at the surface, decreasing to three-eighths of an inch where the hole enters the bowl, which makes it evident that a stem could not be used with such a pipe unless it were bound to the bowl with a lashing of some kind, probably of hide. The wall of this bowl at its upper rim is ground until it is scarcely thicker than the cutting edge of a knife blade, the specimen being similar in

shape to many of the earthenware pots of the natives. Pipes of this type vary both in size and exterior form, probably as much as do those of any type found on the continent. Some appear to have been made from natural water-washed pebbles from the streams, and are without any evidence of artificial finish other than that of bowl and stem holes at right angles to each other; others are elaborate imitations of nearly the shape of Greek vases, having at times elaborate figures carved upon their surfaces. The stem holes are usually simple perforations made to intersect the wall of the bowl at its base, though at times upon the surface of the bowl the stem hole is in a slight shoulder projecting from the bowl as though for ornament, but it may well be intended to furnish a better socket for a stem, these being probably much more recent productions than those of simpler form.

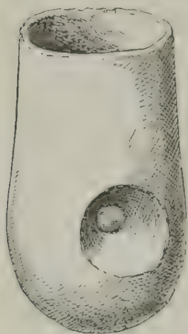

Fig. 49.
STONE URN-SHAPED BOWL.
Cumberland County, Tennessee.
Cat. No. 20129, U.S.N.M. Collected by Lorenzo A. Stratton.

Fig. 50, from Bloomfield, New York, collected by Col. E. Jewett, is made from serpentine, and is 2½ inches long; in outline it is similar to the elongated tubular pipes so widely distributed throughout the United States. In this instance, however, the stem is at right angles to the bowl, the exterior surface is smoothed almost to a polish, though the interior shows the process of enlargement by gouging, so commonly noticed in tubular pipes. At the base of this bowl there is a diagonally bored hole, which perforated the specimen, coming out at the end of the cone. This hole is intended evidently for the attachment of a string, as is the case with so many of the pipes found in countries where deep snows lie. The edges of the bowl and also of the base of this conoidal specimen are notched, the bowl with twenty, and the base with eight incisions. A knife blade, however, fits exactly from one notch across to another, both at top and bottom, which would indicate that they were intended rather as ornamentation than as scores, such as were at times kept upon the handles of tomahawks and pipe stems. There are upon the surface of this pipe some finely scratched lines, which, owing to erosion or weathering, are so nearly obliterated as to prevent tracing them with exactness, though they appear originally to have been pictographic. There is a pipe of this type in the Smithsonian collection upon which the only visible work of human hands consists of a small hole bored through the shell of a hollow concretion. It has, however, in all probability been employed as a pipe, as it is badly cracked from heat.

Fig. 50.
STONE BOWL WITH THONG HOLE.
Bloomfield, New York.
Cat. No. 6128, U.S.N.M. Collected by E. Jewett.

A similar concretion (Cat. No. 136978, U.S.N.M.) was found in a mound in Mason County, West Virginia, by Mr. R. W. Mercer, which is 4 inches high with a width of $2\frac{1}{4}$ inches, yellow in color, the stem being a hole one-eighth of an inch in diameter, broken through the shell midway of the natural bowl cavity.

As demonstrating that this type of pipe was used quite recently, reference may be made to a specimen which was found in Haldeman's shell heap, near Bainbridge, Lancaster County, Pennsylvania, in Conroy Township, on the Susquehanna River, close to two trade pipes of English make.

Rev. W. M. Beauchamp refers to a bowl pipe from Madison County, New York, having two stem holes, and Prof. G. H. Perkins illustrates another from near Swanton, Vermont.[1]

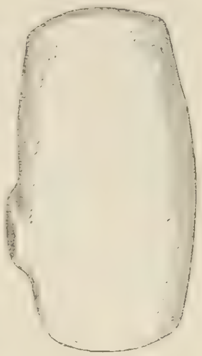

Fig. 51.

UNFINISHED PIPE.

Franklin County, Indiana.

Cat. No. [illegible], U.S.N.M. Collected by R. Haymond.

Schoolcraft illustrates one of these bowl pipes, which is said to come from an ancient aboriginal grave in Michigan at Sault Ste. Marie, upon which a lizard has been carved in relief, with legs spread out to assist in climbing the bowl, above which the head extends on the far side from the stem, facing the smoker, the tail being continued under the bowl. The whole is skillfully executed.[2]

A pipe in every way answering the description of the one referred to by Schoolcraft, and probably identical with it, is in the collection of Mr. A. E. Douglass, of New York.

A large specimen of what appears to be intended for a pipe of this type (fig. 51) is composed of quite a hard, imperfectly crystallized quartzite. It was found in Franklin County, Indiana, and was collected by Dr. R. Haymond. It is $4\frac{1}{4}$ inches long, with a greatest diameter of $2\frac{1}{2}$ inches. There is upon the lower part of this barrel-shaped object an incipient stem. The exterior surface is completed and ground evenly, though not finely, except at the top and bottom of the bowl, which yet remains rough, as left by the hammer marks. On top of the bowl there is a slight depression begun by pecking, as though intended for the reception of the drill point. Though unfinished, this specimen is of more than passing interest, showing as it does the process of manufacture of objects of hard stone.

Fig. 52 is a light green serpentine bowl from Accotink, Virginia, collected by Mr. J. D. Lucas. It is $3\frac{1}{2}$ inches high, with a greatest diameter of $1\frac{3}{4}$ inches, of cylindrical cross section. The bowl is 2 inches deep and five-eighths of an inch in diameter at the surface, having been drilled with a solid point and not subsequently enlarged, as is the

[1]The Calumet in the Champlain Valley, The Popular Science Monthly, December, 1893, p. 240.

[2]North American Indian Tribes, Pt. 4, p. 141.

case with almost all American pipes. A peculiarity of this bowl is the unusually large size of the stem hole, which is quite as large as is the opening of the bowl itself, the walls varying from one-fourth to one-half of an inch in thickness. Around the outer edge of the rim are twelve notches cut at equal distances; while a totemic figure has been scratched on the smooth surface opposite the stem, the significance of which it is impossible to determine. It consists of eight diverging straight lines, arranged in fan shape, from which one other straight line extends toward the top; from this latter line yet another one projects at an angle of 45 degrees, to the right and down; and two other lines diverge at a like angle on the left. The surface of this urn-shaped bowl was originally smoothed with unusual care, and its outline is quite graceful, though the notches and attempt at totemic ornamentation are extremely crude.

Fig. 52.
VASE-SHAPED PIPE.
Accotink, Virginia.
Cat. No. 42681, U.S.N.M. Collected by J. D. Lucas.

The form of this bowl is graceful, but the scratching is not so rude as to suggest that in such pipes the art of the whites and the Indians is combined, the savage owner having added his barbaric decoration to the object received from the Europeans. Were this the case in a single instance it would be insignificant, but as it is observable in dozens of cases it is tolerably conclusive evidence.

Among bowl pipes of vase-like form they are found to vary from those which are as broad as they are long to specimens having a height four times as great as their diameter. This type is usually made from steatite, or kindred stones, capable of resisting heat, though, as with almost all American pipes, there are numerous exceptions to the rule. One, in the Smithsonian collection, of gray sandstone was found in a cave on Tar River, Yancy County, North Carolina, and another, found in a kitchen heap in Kanawha County, West Virginia, which was made from a brown stone. Other specimens are known of this type made from partially decomposed limestone, feldspar, and even fossil coral. The writer is informed by the Rev. W. M. Beauchamp that this type is frequently encountered in Onondaga County, New York.

Pipes of this urn-shaped type are found also along the headwaters of the St. Lawrence, on the south shores of Lake Ontario and Lake Erie, and along the upper waters of the Ohio and its affluents, a typical specimen being from Accotink, Virginia, while yet other specimens in the U. S. National Museum collection are from New York, Pennsylvania, Ohio, West Virginia, Kentucky, Tennessee, Indiana, and North Carolina.

If the area of distribution of the urn-shaped pipe is compared with the tribal distribution first known to the whites, as it appears on Powell's linguistic map, it will be seen that this especial form of the

bowl pipe is found in Iroquoian territory on the north, through the Algonquin on the south, into the southern Iroquoians. It should be remembered that this area corresponds, reasonably, with the territory influenced by French trade before the advent of the English. The territory also is in the line of travel from the St. Lawrence to the Ohio. The writer is unable to determine how far the urn type of pipe has been governed by European influences. Its contour is similar to that of pottery bowls from Tennessee, specimens of which are in the U. S. National Museum collection.

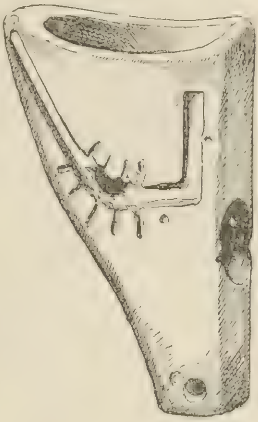

Fig. 53.

RECTANGULAR STONE PIPE.

Sterling, Connecticut.

Cat. No. 17,049, U.S.N.M. Collected by J. H. Clark.

Fig. 53 is a rectangular steatite bowl from Sterling, Connecticut, collected by Mr. J. H. Clark. It is $2\frac{1}{4}$ inches high, $1\frac{1}{2}$ inches long from front to back, though only five-eighths of an inch from side to side. The incised three-sided groove shown in the figure is on both sides, and there can be no doubt was intended for the purpose of inlaying with metal or shell, probably the former. The markings radiating from the groove only appear on one side of the bowl. There is a hole bored through the base of this specimen from side to side, evidently intended to receive a string which would be attached to the stem. It appears to the writer that pipes with holes for attaching bowl and stem, or for whatever purpose the hole was intended, are much more common in the North than in the South, which may be because of the greater liability to loss in the snow than in the grass or among leaves. A pipe, however, somewhat similar in general characteristics to this, in the collection of the University of Pennsylvania, is said to have come from North Carolina, though in place of the hole for the string there is a small knob on its base, as though intended for a similar purpose.

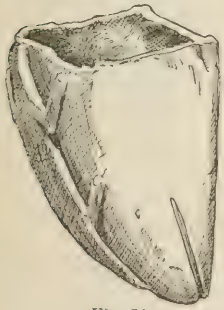

Fig. 54.

ANIMAL PIPE.

Middleboro, Massachusetts.

Cat. No. [illegible], U.S.N.M. Collected by S. H. Sylvester.

Fig. 54, from Middleboro, Massachusetts, collected by Mr. S. H. Sylvester, is made of a steel-gray serpentine, and is apparently not alone intended to show the lizard crawling over the convex side of the bowl, but an incision on each side of the lower point would indicate an intention to convey the idea of some animal's head and mouth as well. The sharp edges of the lizard's body, legs, and head indicate the use of a metal tool in cutting the stone. Though the design is apparently of that character which is common among Indian pipes, the shape of the bowl cavity is quite unusual, being square, an uncommon circumstance, though elliptical openings are not rare.

It may be said with some degree of certainty that fig. 55 represents a dog, wolf, or fox. The ears of the animal are carved in relief and the lines representing the mouth are incised. This pipe is made of a steel-gray serpentine, collected by Dr. T. H. Bean from Lancaster County, Pennsylvania. The lines of ornamentation on this pipe are of the most primitive character and strictly in accordance with savage conventionalism, crossing each other in a manner common in Indian etchings, whereas the shape of the pipe itself is not without merit, being graceful and sufficiently accurate to give a fair idea of the animal intended.

Fig. 55.

ANIMAL HEAD PIPE.

Lancaster County, Pennsylvania.

Cat. No. 27038, U.S.N.M. Collected by T. H. Bean.

There is a cut under the neck of the creature which looks as though it were made with a metal blade, though it appears much more fresh than the rest of the work. There is no other work upon this pipe which may not have been done with the most primitive implements.

A difficulty constantly confronting archæologists is that discoverers of aboriginal specimens frequently scrape incisions with metal tools, making it extremely difficult to distinguish between old lines and new.

This pipe has the bowl and stem hole of like size, each being approximately three-fourths of an inch in diameter at the surface, and therefore resembles the cavities in the biconical pipes, though the latter are seldom, if ever, so small.

Fig. 56.

ANIMAL HEAD PIPE.

Piqua, Miami County, Ohio.

Cat. No. 99187, U.S.N.M. Collected by C. T. Wiltheiss.

Fig. 56, from Piqua, Miami County, Ohio, collected by Mr. C. T. Wiltheiss, is a curious pipe made of a light gray sandstone, in imitation of the head of some animal, though in this case, as in many others, it would be difficult to identify it. The mouth, ears, eyes, and nostrils are each distinctly shown, though the tool marks with which the work was done have been obliterated. In the collection of the University of Pennsylvania Museum there is the head of an animal, carved from a gray sandstone found in West Virginia, not dissimilar to the head here figured, the mouth of which is partly open, showing the tongue.

Fig. 57 is a cast of a curious banded-slate bowl pipe from West Virginia, collected by Mr. B. H. Harrison. Upon the surface facing away from the smoker there is a rudely executed human face. The mouth is an incised straight line, as is the lower end of the nose, the eyes being indicated by slight depressions, evidently made with the point of a drill. Upon the cheeks of this face are a number of irregular figures

cut in parallel straight lines, intended to represent tattoo marks or streaks of paint.

This pipe is 2 inches high, though from front to back it is less than half an inch thick, the bowl being so small that it would scarcely hold a thimblefull of tobacco, the stem hole being so shallow as to prevent a stem being attached without great difficulty. This pipe must be considered rather in the nature of a freak than as belonging to any particular type, and is more in accordance with savage art than are the many specialized objects.

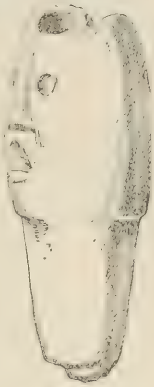

Fig. 57.
HUMAN HEAD PIPE.
West Virginia.
Cast, Cat. No. 95379, U.S.N.M.
Collected by B. H. Harrison.

Fig. 58 represents a cast of a bowl found in Sandusky, Ohio, collected by Mr. Lewis Leppleman, and appears unique among pipes of this type. The figure appears highly conventionalized, though it is sufficiently well shaped to determine that a bird, possibly an owl, was intended. So far as may be determined from the cast, there is no work on this specimen which may not have been accomplished by means of the most primitive implements, even of stone or shell, and could be quite easily executed with the aid of copper.

Fig. 58.
BIRD PIPE.
Sandusky, Ohio.
Cast, Cat. No. [illegible], U.S.N.M.
Collected by Lewis Leppleman.

Fig. 59 is yet another specimen of bowl pipe represented in the U. S. National Museum collection by a cast. It was collected near Valley River, Murphy, North Carolina, by Gen. G. T. Wilder. It is difficult to determine what the head attached to the bowl was meant to represent, though from the crescent-shaped lines on the sides of the bowl it is probably a bird. The head on this bowl is not unlike those on the projections of some of those ponderous pipes found often in North Carolina and Tennessee, and coming from North Carolina is probably merely an evidence of a desire to produce a unique specimen, the bowl and stem cavities being respectively seven-eighths and five-eighths of an inch in diameter.

Fig. 60 is a finely ground dark green serpentine bowl, which is quite similar to the preceding, though having more graceful lines and being more highly finished. It is shaped to represent a bird's head, the eyes being indicated by circular incisions rudely cut and the beak being of a shape to suggest that an eagle or hawk was intended, though whatever the bird, it is rather of conventional than natural shape, the mouth being represented by symmetrical curves corresponding on each side of the beak. The surface of this pipe is smoothed with such skill that all tool marks have been entirely obliterated, and while the surface is perfectly smooth, there has been no effort made to polish it.

The striæ left by the drill in boring it out are so sharply cut as to leave no room to doubt that the work was done with a tool of metal, quite likely of steel.

The perfection of finish and artistic pose of the bird represented in fig. 61 should be good reason for considering it one of the most perfect of American pipes. It is made of a black serpentine collected in Mineral County, West Virginia, by Mr. J. A. Davis, and represents some water bird, probably a swan or goose. The graceful pose of the head and neck of the bird is nearly perfect. It is represented in the act of dressing its feathers. Well down on the neck are nine sharply incised lines, each three-fourths of an inch long, all of them straight and parallel. The wings extend well down on the body and are slightly raised above the surrounding surface. The breast has been brought to a high polish. Into the surface of it have been drilled about 150 small circular depressions. These shallow holes are scattered without order, though they are nearly equidistant. While many aboriginal stone relics of the Indians are well ground and brought to a smooth surface, polish is of such rare occurrence that one is inclined to suspect white influences wherever it is encountered. Among American implements it is probably more noticeable in the gray tubular serpentine horns from Ohio and West Virginia than in any other objects. It must be admitted there is no work upon this pipe, if we except its polish, which could not be done with primitive tools, though there is doubt if it is purely aboriginal.

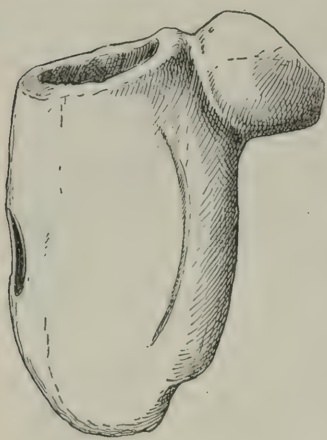

Fig. 59.
BIRD PIPE.
Murphy, North Carolina.
Cast, Cat. No. 30250, U.S.N.M. Collected by G. T. Wilder.

There is in the collection of casts of the U. S. National Museum (Cat. No. 22176) one from Scioto County, Ohio, much on the order of the swan pipe, which was intended possibly to represent a loon.

Fig. 60.
BIRD PIPE.
Williamson County, Tennessee.
Cat. No. 19978, U.S.N.M. Collected by M. W. Clark.

Pipes, generally of local types, appear to be found throughout the continent under similar conditions of surroundings to that of other aboriginal objects, on the surface, in shell heaps, in graves of all kinds, among the Pueblo ruins, in the mounds, and in the caves. Even the English trade pipe

has been found 6 or more feet below the surface of the earth associated with implements of the age of stone.

The Rev. W. M. Beauchamp, thoroughly competent to express an opinion on the subject, and especially familiar with the aboriginal remains and implements of New York, considers that the pipes of stone, of which the larger part of New York specimens are composed, are comparatively recent. Until the coming of the whites most New York pipes were of clay, the Narragansetts making those of stone, but with the use of steel tools stone pipes became common. Catlinite pipes, other certainly than the plain rectangular Siouan ones, are probably quite modern, for that material seems to have been almost unknown far from the Siouan sphere of influence until near the close of the seventeenth century.

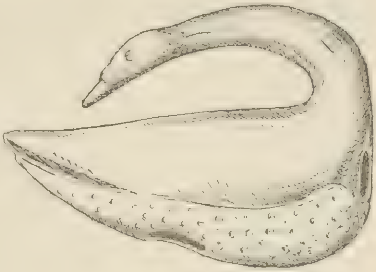

Fig. 61.

SWAN PIPE.

Mineral County, West Virginia.

Cat. No. 11527, U.S.N.M. Collected by J. A. Davis.

Fig. 62 belongs apparently to the bowl pipes, and is made of a brown pottery well mixed with a tempering of pounded shell; it is $2\frac{1}{2}$ inches high, and from the outer edge of the short stem to the far side of the pipe is the same length; the interior of the bowl has a diameter of $1\frac{3}{8}$ inches, with a depth of only 1 inch; the stem hole, one-half the diameter of the bowl, is $1\frac{1}{4}$ inches deep. The dimensions here given would suggest that possibly this pipe should be classed rather with the biconical or monumental pipe than with those of the bowl type. This object is from Mount Vernon Barracks, Alabama, collected by Dr. Joseph K. Corson. The clay and tempering material are well mixed together, while the ornamentation as well as the manner of producing it are unique; the base is flat and smooth; the design on the bowl is in relief about one-eighth of an inch and covers the whole surface, there being a number of notches cut around the top of the bowl and the rim of the stem. As a pipe the design is pleasing, the stem socket being the most pronounced of any of this type; the ornamented surfaces are comparatively smooth, while between the lines in relief, the depressed surface appears to have been made by means of a scraping or cutting tool, the striæ of which are quite distinct and appear to have been produced by having the bowl, when originally burned, of a uniform surface,

Fig. 62.

POTTERY PIPE.

Mount Vernon Barracks, Alabama.

Cat. No. 19998, U.S.N.M. Collected by Joseph K. Corson.

upon which the design has been traced, and all the rest of the surface scraped or gouged away, leaving the original surface in low relief.

A quaint pipe. made of the base of a deer's antler sawed off where it joins the skull, is shown in fig. 63, from Fort Wrangel, Alaska, collected by Lieut. F. M. Ring, United States Navy. The person who made this pipe has taken advantage of natural form to the fullest extent in leaving the original horn to represent a head covering, or the individual's hair. This grotesque carving is reversible and not devoid of humor, something frequently observed in the carvings and etchings of the Northwest coast. The specimen is evidently modern and made with modern iron tools, though the characteristics are peculiar to the Northwest coast.

Fig. 63.

ANTLER PIPE.

Fort Wrangel, Alaska.

U. S. National Museum. Collected by F. M. Ring.

Fig. 64 presents a combination of savagery and civilization, nature and art, and the present blended with hoary antiquity in a manner than which it were difficult to imagine a more remarkable and striking example. It is from Pottawatomie, Kansas, collected by the National Institute, and is about 4 inches high and made of the outer whorl of an ammonite (probably *Schlœnbachia peruviana*, or *acuticarinata*), the shape of which attracted the curiosity of the Indians. Broken in three pieces, it has been carefully repaired by means of plates of iron on each side, which are held in position by rivets running from plate to plate through the fossil. The face, while rude, is reasonably well modeled and carefully smoothed, and presents the Indian type. Indeed, the work has been so carefully executed as to leave some doubt whether a part of this object, that comprising the head, has not been artificially built up and molded rather than carved from the ammonite. There is no reason to suppose this specimen to be of any considerable age, though it is typically Indian.

Fig. 64.

FOSSIL PIPE.

Pottawatomie, Kansas.

Cat. No. 7825, U.S.N.M. Collected by the National Institute.

Pipes of similar shape to those here figured of the bowl type have been found in many of the States of the Union, though with few exceptions they are noted east of the Mississippi River, and there is no pipe so difficult to place in its proper area as this form: for while certain of them are undoubtedly quite old. others of the same type are certainly of modern workmanship.

Schoolcraft refers to one of these pipes on which a head is carved on the bowl, while on another a lizard is represented crawling up the outside.[1]

Lapham refers also to a bowl pipe found in a mound in Wisconsin, made of argillite, which presents the unusual feature of having a horizontal opening on both sides.[2]

Dr. E. A. Barber refers also to a large stone council pipe belonging to Mr. W. S. Vaux, of Philadelphia, found in a grave in West Philadelphia, which was discovered with a necklace of stone beads, the pipe being 6 inches high, cylindrical, and tapering in form. About 2 inches from the base, which is 8¾ inches in circumference, extends a horizontal groove in which have been pierced four equidistant stem holes which extend obliquely downward to the base of the bowl.[3]

Prof. W. H. Holmes called the writer's attention to a bowl pipe made of earthenware, found by Mr. Henry P. Hamilton, at Two Rivers, Wisconsin, apparently intended to represent the bloom of the tobacco plant or possibly an orchid, of beautiful shape, symmetrical in every way, suggesting modern influences though found associated with undoubted aboriginal implements.

Prof. G. H. Perkins also has figured a dark steatite pipe, found on Grand Isle, in Lake Champlain, which he considers one of the most interesting of all the pipes of Vermont, having faces carved upon it in bold relief, with two lines running one from either side of the nose of these faces, and Professor Perkins says there is only one other pipe having a face carved upon it in the Champlain Valley, and "singularly this face also has lines under the nose, which may indicate the mustache of a European."[4]

A pipe of somewhat similar character, made from alabaster, having two faces upon the upper edge of the bowl, is in the Douglass collection, New York City, and was found in Wyandot County, Ohio. Still another stone pipe of this character from Texas, collected by Hon. George M. Keim (Cat. No. 6672, U.S.N.M.), has four faces carved on the upper edges of the bowl, which is somewhat broken. Around the sides of the jaws of this pipe, however, are striae which have every appearance of being made with a file, and the hole for the stem is disproportionately large compared with the opening of the bowl.

While such may exist in museums or private collections, the writer has not encountered any reference to this type of bowl form made from pottery. It is difficult to see how the majority of pipes of this type were attached to their stems because of the thinness of the wall of the bowl and the wide opening of the stem hole, which, because of being drilled with a solid point, is so shallow at its entrance into the

[1] North American Indian Tribes, Pt. 2, plate 44, p. 89.

[2] Antiquities of Wisconsin, p. 28, Smithsonian Contributions to Knowledge, VII.

[3] American Antiquarian, I, p. 113.

[4] The Calumet in the Champlain Valley, The Popular Science Monthly, December, 1893, p. 242.

bowl that it leaves no purchase or room to attach a stem by merely forcing it in tight. This suggests that stems were attached by means of rawhide strips wrapped around bowl and stem while wet and allowed to dry, whereby the stem and bowl would be held together in a manner as perfect as possible.

There appears scarcely a limit to the variations of this type, which was shaped chiefly to suit individual tastes, and was of a form handy to carry. One coming under the writer's notice was made from a pistol cartridge, having a bird-bone stem, held in position by rawhide tightened in the manner above suggested.

It would require a book to itself to attempt thoroughly to treat the subject of pipestems—their decoration, and the material from which they are made, which would include stone, bone, horn, ivory, wood, and quills. Some of the pipes were apparently smoked without stems separate from the pipes, notably the curved base pipes of the mounds, though even they may possibly have had quill stems attached.

Tubular pipes were generally smoked by means of bone, wood, or even stone stems, inserted in the smaller end of the tube, as is indicated by its interior enlargement. In California, and among the Pueblos and cliff dwellers, these mouthpieces were held in position by means of bitumen or gum, though there is little direct evidence as to the method employed in the eastern portion of the United States to hold the tubular pipestems in place; similarity in shape of tube would suggest like methods. Pipestems of wood—round, flat, curved, bent, and carved, long and short—are common from the Rocky Mountains to the Atlantic Ocean, the Indian being governed in the character of stem largely by the supply of material in the territory to which he had access either personally or through trade. Reeds and jointed roots would naturally be employed where available; before the arrival of the whites with their metal, the proposed stem would have to be split through longitudinally; the joints on the inside being removed, the split pieces could be glued together again or bound with bark or hide. The stems, if of wood, would be split in the same manner and each of the split pieces, after having a narrow channel cut along its entire length, could be rejoined, when the channels would form a tubular opening from end to end of the stem, allowing free passage to the smoke. These split pieces, when not refitting satisfactorily, often had strips of hide or bark glued to the crack, when they would be bound in the usual manner.

Judging from such descriptions of pipestems as have been preserved to us through various publications, it will be observed that from the time of the earliest French and English contact with the natives, pipestems have been highly ornamented and often decorated with bright colors, feathers, fur, and dyed hair, and more recently with bright flannel of various shades and large-headed brass or silver nails driven into smooth surfaces in rows or scrolls. The ornamentation of the stems of ceremonial pipes appears to have had great significance, for not only

could one thereby determine to what tribe they belonged, but could even decide at a glance whether the one bearing it came on a friendly or hostile mission. The very early pipes, especially those referred to by the French, we know were red, white, or black, and we rarely find allusions to ornamentation of their bowls, but when we do it refers to color; whereas particulars are usually gone into in reference to the stem, the color of feathers composing the decoration, the birds composing them, or how a hoop of hair was attached to the stem and arranged.

The pipe among many of the tribes appears to have protected its bearer so long as he was on his errand, even among bitter enemies. That the pipe had the sanctity commonly attributed to it by early writers is demonstrably inaccurate, for there are numerous records of the pipe bearers not being received, and even of receiving them and subsequently of escorting them a certain distance from camp and then knocking them in the head with scant ceremony.

All wooden pipe stems are not round; some are flattened parallelograms, others are triangular, ellipsoidal, or even square; some are soft, being made of the quills of birds; others are of stone and of a size offering difficulties in inserting them in the smokers' mouth.

The angle of bowl to stem varies from those in which both are in a common plane to those in which bowl and stem are parallel to each other.

Mr. W. H. Dall relates that "the Hudsons Bay men make passable pipe stems by taking a straight-grained piece of willow or spruce without knots and cutting through the outer layers of bark and wood. This stick is heated in the ashes, and by twisting the ends in contrary directions the heart wood may be gradually drawn out, leaving a wooden tube."[1]

Hind describes a unique pipe used on a certain occasion by a Cree Indian. "I asked," he says, "what he would do for a smoke until he had finished the new pipe. He arose and walking to the edge of the swamp cut four reeds and joined some pieces together. After he had made a hole through the joints, he gently pushed one extremity in a slanting direction into the earth, which he had previously made firm by pressure with his foot. He then cut out a small hole in the clay, above the extremity of the reed, and molding it with his fingers, laughingly said, 'Now give me tobacco, and I will show you how to smoke it.' He then filled the hole with a mixture of tobacco and the bearberry, placed a live coal on the top, and stretching himself at full length on the ground, with his chin supported by both hands, he took the reed between his lips and enjoyed a long smoke."[2]

While this pipe was certainly most primitive, we have an account of one yet more simple, the description of which is taken from a recent newspaper clipping given the writer, in which a glimpse is shown of a

[1] William H. Dall, Alaska and its Resources, p. 81, Boston, 1890.

[2] Hind, The Canadian Red River, II, p. 138, London, 1860.

Kaffir pipe, and a native smoking it to produce stupefaction, as many American tribes have done, and yet do. "He, the Kaffir, first pours a little water on the ground and makes a sort of mud pie: he then takes a limber twig and bends it into the shape of the bow: this he buries in the mud in such a way that both ends protrude a little at the surface. He then waits a little for the mud to harden. When he considers the pie is done to a turn, he pulls out the twig, which of course leaves a curved hole through the clay. At one end he scoops out a sort of bowl, in which he places his tobacco; at the other end he fashions a little mound to serve as a mouthpiece. He drops a live coal on the tobacco in the bowl, lies flat on the ground, applies his thick lips to the orifice and sucks away. He mixes with it a liberal quantity of dagha, a kind of hemp with intoxicating qualities, similar to those of hasheesh. By the time the pipe is finished the smoker falls over in a fit."

The Igorottes, or mountaineers of Formosa, who are head hunters, have a curious custom relating to the pipe. They watch the coast dwellers coming in search of wood, who are attacked and decapitated; when heads to a certain number have been taken by one of them, "he obtains by way of honor the right to sell pipes,"[1] which are little bits of wood representing human heads.

HEAVY ANIMAL AND BIRD PIPES.

We have in fig. 65 a type specimen of the heaviest of any of the American Indian pipes with which the writer is acquainted, and in fact the only one so far discovered which would fully serve, from its size and weight, to "brain a man or a horse," and which was "three-quarters of a yard long." The one here illustrated is from Blount County, Tennessee, collected by Dr. Blankinship. The bird represented may be either owl or parrot, probably the former, and differs from pipes of this type in having the stem hole in the breast of the bird. It is a light bottle-green chlorite, 10 inches long, $4\frac{1}{2}$ inches high, with a width of $2\frac{3}{4}$ inches. The opening of the bowl is about $1\frac{1}{2}$ inches in diameter, that of the stem being about three-fourths of an inch. The surface of this pipe is smoothly worked down except on the back, where the wings are

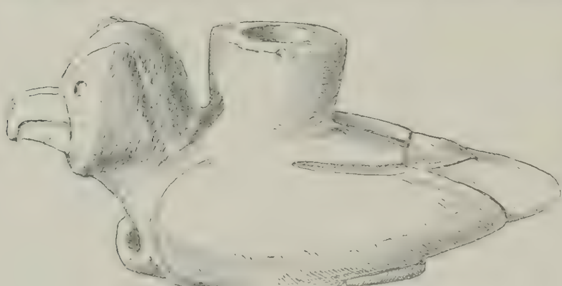

Fig. 65.

STONE BIRD PIPE.

Blount County, Tennessee.

Cat. No. 23300, U.S.N.M. Collected by J. M. Blankinship.

[1] Littell's Living Age, October 19, 1895, quoting La Journal des Voyages.

represented; there the tool marks remain quite distinct. The wings are folded, and the feet are represented as drawn up under the body.

Gen. A. L. Pridemore, of Lee County, Virginia, has a specimen of this character which weighs 3 pounds 2 ounces, which was found under 15 feet of soil in a railroad cut in 1889, and which he thinks represents an osprey. Another specimen belonging to him represents a duck, and

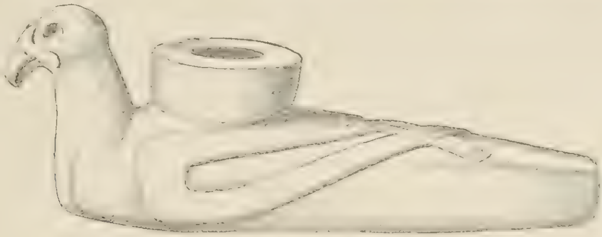

Fig. 66.

STONE PIGEON PIPE.

Decatur County, Tennessee.

Cat. No. 58853, U.S.N.M. Collected by W. M. Clark.

was found twenty years ago in an Indian grave. Quite a number of pipes of this type are figured by Thruston among the antiquities of Tennessee, and others by Joseph Jones, in his work on Tennessee.[1] Jones describes a specimen of "dense, chocolate-colored steatite, representing a bird of prey, probably a bald eagle."[2]

The stem holes in pipes of this type are so placed in a majority of

Fig. 67.

STONE WOOD DUCK PIPE.

Cumberland County, Tennessee.

Cat. No 20125, U.S.N.M. Collected by Lorenzo A. Stratton.

instances that the bird or beast—for both are represented—faces from the smoker, and the specimens as a rule are well finished, the tool marks on the exterior being usually entirely obliterated, though the drill marks and evidences of enlargements of the bowls and stems are quite distinct.

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[1] Explorations of the Aboriginal Remains of Tennessee, Smithsonian Contributions to Knowledge, No. 259.

[2] Idem, p. 103, fig. 58.

There can be but little doubt that fig. 66 is a representation of a wild pigeon, a bird which but a few years ago migrated south in the fall and north in the spring to their breeding grounds. They were in such vast numbers as to break the limbs of the trees where they stopped to roost or to feed on acorns, and in their flight would obscure the face of the sun for hours at a time. This pipe was found in Decatur County, Tennessee, collected by Mr. W. M. Clark; it is 11 inches long, 4 inches high, and the bowl is 2 inches in exterior diameter, the diameter of the interior of the bowl being $1\frac{3}{8}$ inches, and the opening of the stem, which is located under the tail of the bird, is about one-half the diameter of the bowl; and as a rule this proportion of the bowl and stem holes will hold good in the type. The head and body of this bird are tolerably well formed, though the wings, it may be seen, are treated in a purely conventional manner, crossing on the back near their points, the bird being carved from a black chlorite. The eyes of these birds are depressed, though it would be difficult to say whether it was intended in any case to insert artificial ones. The pigeon, like the buffalo, has disappeared so completely from its former haunts, that one would hardly know which way to turn to obtain a specimen were it desired for a collection.

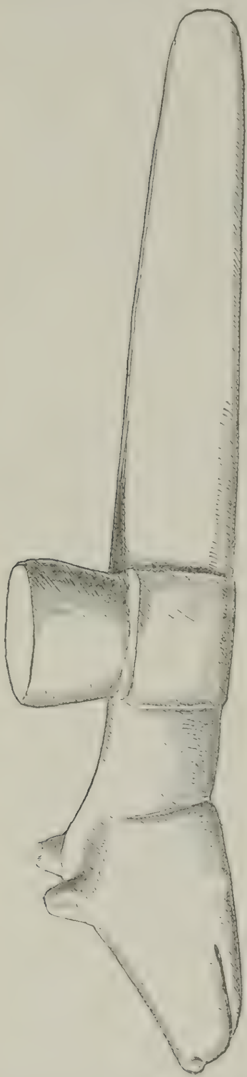

Fig. 68.

ANIMAL HEAD, STONE PIPE.

Jackson County, North Carolina.

Cat. No. 98029, U.S.N.M. Collected by G. A. Jacobs.

Unfortunately the specimen is broken, yet what remains of fig. 67 is an unusually spirited example of the wood duck—of all American birds the one with the most beautiful plumage. It is of steatite, from Cumberland County, Tennessee, is 9 inches long, 4 inches high, and $4\frac{1}{2}$ inches wide; and was collected by Mr. Lorenzo A. Stratton. The break of this pipe is through its plane of cleavage, and as the specimen has been completed the break has occurred since it was finished. The crest and legs of the bird, the latter poorly executed, leave no doubt that the wood duck was intended. The feathers are rudely designated on the wings in wavy lines with the point of some rude tool, possibly of stone.

It is remarkable that the stems of certain of these pipes are so worn on their outside as to indicate that they have come in direct contact with the teeth of the smoker, though the ordinary interior stem enlargement is similar to that of the elongated conical pipes of California. Lanman probably referred to a pipe of this character, found in 1848 or earlier, 15 feet below the surface, in Macon County, North Carolina, made in imitation of a duck.[1] A broken specimen from Ohio above Cincinnati is in the Museum of the University of Pennsylvania.

Fig. 68, from Jackson County, North Carolina, collected by Mr. G. A. Jacobs, is an unusually large specimen of an unfinished pipe, made of steatite, which is 19 inches long, 4 inches high, and 3 inches wide, and weighs 9¾ pounds, and used as a weapon would really be terrible.

There are few surface indications showing the striae of the tools with which these implements were originally made, and it is impossible to say from an examination of many specimens whether stone or metal tools were used, as the surfaces have been smoothed off. As the shape of this pipe is perfect, it would indicate that it was intended for use in its present condition. If, however, it was intended that the bowl and stem were to be bored out, which was probably the case, it would indicate that this was one of those "great pipes" to which reference is so often made in works of early North American travel, the size of which distinguishes them from pipes intended for individual use. Pipes of this type vary from 6 to 19 inches in length, and are apparently totemic. One specimen in the U. S. National Museum (Cat. No. 34383), from Anderson County, Tennessee, collected by Mr. W. H. Taylor, has a head on it, but it is impossible to determine whether it represents a turtle or a bird, though the head in the last illustration was probably that of a dog or wolf. Another specimen, representing an animal, has the legs cut out in low relief, so that they look as if they were made of separate pieces subsequently glued to the surface.

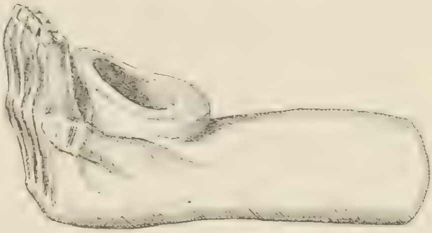

Fig. 69.

HUMAN HAND AND ARM.

Western Tennessee.

Cat. No. 97433, U.S.N.M. Collected by W. M. Clark.

Though differing in several respects from the preceding specimens, fig. 69 appears in bowl and stem characteristics to belong to the type here described, though it is made of a dark, almost black, chlorite. It is from western Tennessee, collected by Mr. W. M. Clark, and is 6 inches long, 3 inches high, and 2½ inches wide, and represents a bowl being held in six fingers of a left hand. The knuckles and nails are all well represented. A similar specimen, though of pottery, from Arkansas, will be found among the biconical pipes (fig. 162), where this would

[1] Charles Lanman, Letters from the Alleghany Mountains, p. 24, New York, 1849.

have been placed were it not that the size of the stem opening and of the opening of the bowl were so typical of these heavy pipes. Another hand, holding some object, is in the Steiner collection, from the Etowah mound, Georgia. Thruston in his Antiquities of Tennessee represents a pipe of this general type, the figure being a bird with outstretched wings,[1] and another in which the bird is on its back, the bowl protruding from its breast.[2] One specimen represents the human foot and a part of the leg, the bowl coming out on the shin bone near the instep.[3] In this specimen the toes are well carved.

The occurrence of the hand, arm, foot, and leg in pipes of this type would suggest that they were exceptions to the general rule and have no totemic significance.

In many of its characteristics fig. 70 would appear to belong to this type, yet in some respects there are features which would possibly entitle it to be classed in an indeterminate group. This pipe is from Chillicothe, Ohio, collected by Dr. E. H. Davis, and has the body and wings of a bird, with the head of a man facing to the right of the smoker; and an enlargement along the back of the man's head and neck is suggestive of the old-fashioned cue of the whites. The stem of the pipe enters the bowl, intersecting it at right angles, and is perforated through the wing instead of under the tail, as is commonly the case. A clay pipe, representing a panther facing to the right, is among the Iroquoian pipes and other specimens of men and birds or beasts are from New York and Ontario, and a bird on a mound pipe from Illinois faces also to the right.

Fig. 70.
BIRD WITH HUMAN HEAD.
Chillicothe, Ohio.
Cast, Cat. No. 7211, U.S.N.M. Collected by E. H. Davis.

Old Chillicothe, on the Little Miami River in Ohio, is the place to which Daniel Boone, in 1780, says he was carried a prisoner by the French and Indians, by whom he was captured, though while a prisoner he appears to have been treated with unusual consideration, the king of the Shawnees, he says, having adopted him.[4]

Squier and Davis illustrate a pipe of this general character, though of the tubular type, bowl and stem being in the same plane, upon which a bird is carved with its back attached to the tube, found in a mound on the Catawba River, Chester District, South Carolina, the specimen

[1] Antiquities of Tennessee, p. 203, fig. 105.
[2] Idem, p. 205, fig. 108.
[3] Idem, p. 190, fig. 87.
[4] John Filson, Histoire de Kentucke, pp. 74, 79, Paris, 1785, translated from English by John Parrand.

being 10 inches long and 2 inches wide, weighing a little less than 4 pounds.[1]

While steatite appears to be the most common mineral employed in making these pipes, chlorite and serpentine were also used at times. An examination of the dimensions of bowls and pipes of the American Indians demonstrates almost conclusively that the size of bowl and stem are in relative proportion through contiguous territory, with scarcely an exception in any given type, though material and exterior finish vary considerably. Gen. A. L. Pridemore has a pipe of this type, having upon it the head of an eagle, and another a duck, from Lee County, Virginia, which he considers of Cherokee origin. Mr. A. F. Berlin, of Allentown, Pennsylvania, has a white stone pipe, a surface find, from Franklin County, North Carolina, in the shape of a duck, the bowl of which is rectangular. The University of Pennsylvania has a bird pipe catalogued from Georgia, and a specimen of this type in the Douglass collection from Cumberland County, Kentucky, has engraved upon its side the figures 1714. The wings, tails, and topknots of birds in this type are usually highly conventionalized, and in only one instance does the writer recall an effort having been made to represent individual feathers, and even in that case the work was quite rudely done.

Pipes of this kind are of the most ponderous character of any American type known, and Strachey's description of the pipe would really answer for this, and he does not exaggerate when he says the pipe of a "Susquehannock Indian" was "three-quarters of a yard long, prettily carved with a bird, a deare, or with some such device at the great end sufficient to beat out the braynes of a horse,"[2] though he has evidently copied John Smith's earlier description, who asserted that these pipes were sufficient to beat out a man's brains.[3]

This pipe appears also to be the only one which satisfactorily answers John Smith's description of having carvings at their great ends.

USE OF PIPES AND TOBACCO BY THE WHITES.

English and American authors usually give to Sir Walter Raleigh the credit of introducing tobacco into Europe about the year 1586, though it is highly probable the French had used it at an earlier date; the Spanish certainly used it even earlier than the French.

In 1585 Sir Richard Grenville had command of the expedition of Sir Walter Raleigh, consisting of seven sail, an account of which we have from the pen of Ralph Lane, one of the captains of the fleet. In 1586 Sir Francis Drake also visited the colony of Virginia, from which time the coast of the continent became familiar to European sailors.

[1] Ancient Monuments of the Mississippi Valley, p. 226.

[2] William Strachey, Historie of Travaille into Virginia, p. 40, 1612 (Hakluyt Society).

[3] William Stith, History of the First Discovery and Settlement of Virginia, p. 68, 1747, Sabin reprint, New York, 1865.

Among discoverers of the coast prior to 1610, as mentioned by Henry Ellis, were Capt. John White in 1587, B. Gosnell in 1602, George Weymouth in 1602, Hendrick Hudson in 1607,[1] and John Smith in 1606 and 1608. All of whom were of course preceded by the Spanish and Ribault made the coast of Florida in 1562 with a French expedition, who, after discovering the St. Johns River, went up the coast to Port Royal, located a fort, and returned to Europe. The garrison quarreled, and Laudoniere in 1564 again reached the coast with Ribault. The third French expedition carried a thousand men or more, all of whom, it is asserted, were massacred the same year by the Spaniards, who a few years later were themselves massacred by Gorgues, a Frenchman. These people were followed by a host of minor adventurers whose names have not survived, and all we know of them is from some casual remark of a certain number of sail being in port, or it may be some writer referring to objects of European manufacture being in the Indians' possession which could only have come from a wreck. From about 1610 the American continent became the storehouse which supplied material for European adventurers. They fished the waters and roamed the woods in search of peltries, especially those of the mink, the beaver, and the otter, which they trapped or bought with trinkets of white man's manufacture always made for aboriginal trade or exchange. Almost annually, beginning with Raleigh's expedition, voyages doubled in number, and after the year 1600 Spanish, French, English, and Dutch, regular traders and pirates, fought and schemed against each other, often publishing erroneous reports, and it is even asserted going to the extent of issuing false maps for the purpose of misleading their rivals. The Spanish and French on the coast of Florida and the Carolinas cut each other's throats until they both abandoned their possessions. Subsequently the English occupied the Carolinas, and on the northern coast French, Dutch, and English were repeatedly guilty of the rankest acts of piracy upon each other. The French settled in Canada, and the Dutch held tenaciously to the trade of New York, and tobacco became a most important article of merchandise over the greater part of the continent. Gaffarel claims that Thevet, a Frenchman, is entitled to the credit of introducing tobacco into France as early as 1554.[2]

On the other hand, it is asserted that tobacco was first brought into Europe in 1558 by Francisco Fernandez, a physician who had been sent by Philip II of Spain to investigate the products of Mexico.[3]

Jean Nicot, ambassador of Francis II to Don Sebastian, King of Portugal, about 1559, sent seeds of the tobacco plant to Queen Catherine De Medici, and his services were commemorated by the scien-

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[1] Henri Ellis, Voyage à la Baye de Hudson, Leyden, 1750.

[2] Justin Winsor, Narrative and Critical History of America, IV, p. 31.

[3] Encyclopædia Britannica.

tific name *Nicotiana*. According to Nadaillac the Spaniards and Portuguese introduced tobacco into Europe in 1518. Cortez sent seeds of the plant to Charles V. Raleigh offered tobacco as a present to Queen Elizabeth in 1586, whence the use of it spread to Holland, then to the numerous colonies of these two countries, and thence with a strange rapidity to Asia, Africa, and the limits of the habitable world.[1]

William Bragge calls attention to a matter which could not fail to impress any one at all familiar with the subject that "the early bibliography of tobacco develops the fact that its introduction was greatly facilitated by the supposed benefits which its use would afford the individual from a medicinal standpoint."[2]

Bragge's collection of pipes, now in the British Museum, made from all parts of the world, and his books relating to tobacco, the former consisting of 13,000 specimens and the latter of 500 volumes was as rich as it was curious, and has probably never been equaled. The medicinal and imaginary properties attaching to tobacco have been marked among the American Indians to no greater extent than in Europe. Rembert Dodoens in 1578 said "the perfume of dryed leaves, he sayd he layde upon quick coles taken in the mouth through the pipe of a funnel or tunnel, helpeth such as are troubled with shortness of winde and fetch their breath thicke and often."[3]

Thomas Hariot, who accompanied Raleigh's expedition to Virginia in 1584, says: "there is an herbe which is sowed apart by itself and is called by the Indians uppowoc: in the West Indies it hath divers names, according to the several places and countries where it groweth and is used. The Spaniards generally call it tobacco. The leaves thereof dried and brought into powder they use to take the fume thereof by sucking it through pipes made of clay into their stomach and head: from whence it purgeth superfluous fleame and other gross humors, and openeth all the pores and passages of the body, by which means the use thereof not only preserveth the body from obstructions but also (if any be, so that they have not been of too long continuance) in short time breaketh them whereby their bodies are notably preserved in health and know not many grievous diseases wherewith we in England are oftentimes afflicted."[4]

This is probably the first reference to the use of tobacco by an Englishman, and even at the present time such an indorsement of the virtues of a newly discovered plant by a distinguished authority could not fail to be an invaluable advertisement for its use, for Hariot, who carried the tobacco plant to his patron, Raleigh, a favorite at the court

[1] Nadaillac, Les Pipes et le Tabac; Matériaux pour l'Histoire Primitive et Naturelle de l'Homme, November, 1885, pp. 498, 499.

[2] William Bragge, Bibliothica Nicotiana, Birmingham, 1880.

[3] E. A. Barber, The Antiquity of the Tobacco Pipe in Europe, quoting Rembert Dodoens on the virtues of colefoot in the historie of plantes, American Antiquarian, II, p. 6.

[4] Thomas Hariot, Hakluyt's Voyages, III, p. 330, London, 1810, from edition of 1600.

of Queen Elizabeth, appears to have been a botanist of some repute. That Hariot's views concerning the wonderful properties of tobacco were not concurred in by all there can be no doubt, for "it was feared," says Camden, "that by the practice of smoking tobacco *Anglorum corpora in barborum degenerasse videantur.*"[1]

"Lane and his associates" [of Raleigh's expedition], says Robertson, "by their constant intercourse with the Indians, had acquired a relish for their favorite enjoyment of smoking tobacco. They brought with them a specimen of this new commodity to England and taught their countrymen the method of using it."[2]

This is reiterated by Stith, who adds that Raleigh is said to have taken a pipe of tobacco a little before he went to the scaffold, and quotes Camden as thinking that Lane and his associates carried the first tobacco to England, and says: "Sir Walter Raleigh, a man of gaiety and fashion, readily gave in to it, and by his interest and example soon brought it into such vogue at court that many great ladies, as well as noblemen, made no scruple sometimes to take a pipe. It is certain the Queen gave great countenance and encouragement to it as a vegetable of singular strength and power, which might therefore prove of benefit to mankind and advantage to the nation."[3]

There are many anecdotes connected with Raleigh and his use of tobacco, none of which has been oftener repeated than the following: "Sir Walter was smoking in his study, and, being thirsty, called for his servant to bring him a tankard of beer. Jack hastily obeyed, and Sir Walter, forgetting to cease smoking, was in the act of spouting a volume of smoke from his mouth when his servant entered. Jack, seeing his master smoking prodigiously at his mouth, thought no other but he was all on fire inside, having never seen such a phenomenon in all England before, dashed a quart of liquor at once in his face, and ran out screaming, 'Massa's afire! Massa's afire!'"[4]

On another occasion "Sir Walter wagered with the Queen that he would determine exactly the weight of smoke which went off in a pipe of tobacco. This he did by first weighing the tobacco and then carefully preserving and weighing the ashes; and the Queen readily granted that what was wanted in the prime weight must be evaporated in smoke. And when she paid the wager she said pleasantly that she had heard of many laborers in the fire that turned their gold into smoke, but Raleigh was the first who turned his smoke into gold."[5]

Spenser, who was a friend of Raleigh, shows in the Faerie Queene,

[1] Sir Robert H. Schomburgk, Raleigh's discovery of Guiana, Introduction, p. xxxiv (Hakluyt Society).

[2] William Robertson, America, p. lix.

[3] William Stith, The History of the First Discovery and Settlement of Virginia, p. 21, New York, 1865, Sabine reprint.

[4] Samuel G. Drake, History and Biography of the Indians, p. 113, note, Boston, 1857.

[5] Stith, The History of the First Discovery and Settlement of Virginia, p. 21.

1590, that the supposed medicinal properties of tobacco had much to do in promoting its use.

> Into the woods thenceforth in haste she went,
> To seeke for hearbes that mote him remedy;
> There whether divine tobacco were,
> Or panachaea, or Polygony,
> She found and brought it to her patient deare;
> The soveraine weede betwixt two marbles plaine
> She pownded small and did in peeces bruze;
> Then atween her lilly handes twaine
> Into his wound the juice thereof did scruze.[1]

Paul Hetzner, who visited England in 1598, says, as quoted by Fairholt: "At these spectacles and everywhere else the English are constantly smoking tobacco, and in this manner: They have pipes on purpose made of clay, into the further end of which they put the herbe so dry that it may be rubbed into powder, and putting fire to it they draw the smoke into their mouths, which they puff out again through their nostrils like funnels."[2]

Aubrey, in 1600, speaking of Raleigh being the first one to popularize tobacco in England, says: "In our part of North Wilts, e. g., Malmsbury Hundred, it came first into fashion by Sir Walter Long. They had first silver pipes; the ordinary sort made use of a walnut shell and a straw. I have heard my grandfather Lyte say that one pipe was handed from man to man round the table."[3]

Of all pipes referred to none appears more primitive than this straw and shell, though it is an additional evidence that to obtain the smoke its votaries will employ anything available to hold the tobacco.

"In 1601 Mr. Secretary Cecil, in a speech, alludes to the then existing monopoly enjoyed by the tobacco pipe makers' guild, which, however, was not regularly incorporated until 1619."[4]

At Elizabeth Island, in 1602, Gosnoll says "no place yields finer tobacco than this island."[5]

The English were looking to the cultivation of tobacco as a source of revenue, for it must be evident the whites were eager to trade with the natives for their peltries, than which nothing brought greater profit and naturally few things had more solid value than a supply of their favorite plant.

The English clay pipe of commerce, or the "trade pipe," as it is more commonly called, which is often found on Indian village sites, both in and on the aboriginal shell heaps of the Atlantic coast, as well as in Indian graves throughout a large part of the territory near the middle Atlantic

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[1] Edmund Spenser, The Faerie Queene, III, stanzas xxxii and xxxiii.

[2] F. W. Fairholt, Tobacco; its History and Associations, p. 58, London, 1859.

[3] Idem, p. 57.

[4] Llewellynn Jewitt, Ceramic Art in Great Britain, I, p. 295, New York, 1878.

[5] John Harris, Voyage to the Northern Part of Virginia by Captain Gosnoll, Voyages and Travels, I, p. 816, London, 1705.

seaboard, was, immediately upon its introduction, eagerly bought by the Indians and was also imitated in primitive pottery, the clay of which was mixed with shells. This was certainly the case along the shores of the Chesapeake Bay during the first half of the seventeenth century. There was, however, in 1605 an insufficient supply of molded pipes among the natives, judging from a remark of Weymouth, who, referring to those of primitive form in latitude 41½° on the Atlantic seaboard, says they were "sometimes made of earth, sometimes of the claw of a lobster; but t'was always something that would hold ten or twelve of ours."[1]

This remark, however, evidences that the English had a particular pipe; that it was of diminutive size, and held scarcely more than a thimbleful of tobacco.

To such an extent was the use of tobacco carried that every effort was made to suppress it, not alone because its odor was to some objectionable, but because of the vast sum which in the aggregate went into its purchase and was dissipated in smoke. The opposition became one of statesmen and of the church; and rigorous laws were passed to suppress its importation into Europe, and severe penalties were imposed on those found smoking in public. There is a certain uniformity in the character of the English trade pipe, the type varying only in the angle of the bowl with the stem, the bowl eventually increasing from quite a diminutive size to its present dimensions. The exterior of these trade pipes are interesting in that they were stamped to suit the maker's fancy, all being molded from a clay which turned white on burning, and on the flat heels of which the owner's name or initial was often impressed in the clay mold. Sometimes, however, it was more elaborate, as for example a man on horseback, a lily, or other device. Later these designs were transferred to the sides of the bowl, one coming under the writer's observation having upon one side of the bowl a figure evidently representing St. George and the dragon, and upon the opposite side Britannia and the lion. This pipe was found in the shell heap under the old French fort at Castine, Maine. Again the representation would be a rose or other flower, and yet more recently the name is found impressed on the stem. All these stamps were intended evidently as advertisements of the particular ware or output of a given factory. The smaller pipes are supposed to be the more ancient by those who have given this feature great attention. The writer is inclined to concur in this opinion from the fact that the most diminutive pipes of the trade type are those which have bowl and stem nearest approaching the straight tube, for during the last two hundred and fifty years the shape has gradually changed until the bowl is at present at right angles to the stem. The small size of the bowl was due to the scarcity and value of the dried plant, its enormous cost being a result

[1] James Rosier, Voyage to Virginia, by Henry, Earl of Southampton, and the Lord Thomas Arundel, performed by Captain Weymouth, John Harris, Voyages and Travels, I, p. 817, London, 1705.

of the many restrictions on its use. The importation of tobacco into England was discouraged by enormous taxation, and there appears to have been a fear felt lest its use would not only impoverish the citizen, but that it was in addition liable to cripple the finances of the nation. There does not appear to be any positive knowledge as to the form of the earliest English pipes, consequently we are forced to a comparison of known English forms with those of the supposed primitive pipe from which the English clay pipe is copied. The heel of the pipe became in time a sharp spur, that decreased until it is now scarcely discernible.

Dr. E. A. Barber refers to a trade pipe with the initials R. T. on its heel, which was found in an Indian grave in Chester County, Pennsylvania, probably the manufacture of one Richard Taylor, of Bath, England: and another was found in Lancaster County, Pennsylvania.[1]

The writer possessed a heeled clay pipe which was found, while digging a well, 6 feet under the surface in Anne Arundel County, Maryland. A similar one was found in an Indian grave in Montgomery County, New York. They have also been found by Mr. Frey, of Palatine Bridge, New York, in Indian graves.[2]

The first tobacco-pipe maker in America of which there is record was Robert Cotton, whose name appears among those arriving in 1608 at Jamestown, Virginia, in the *Phœnix*, the first supply vessel.[3]

Tobacco soon became the crop of Virginia and Maryland, to the exclusion of those crops essential to sustain life, owing to its high price and scarcity.

As has been remarked, the Indians at times used other plants than tobacco for smoking, just as in Scotland it was formerly said to be "common for the old wives of Annandale to smoke a dried white moss," gathered on the neighboring moors, which they declared to be much sweeter than tobacco, and to have been in use before the American weed was heard of.[4]

Percy, in 1607, speaks of the Indian of Virginia "with his arrow ready in his bow in one hand and taking a pipe of tobacco in the other, with a bold uttering of his speech, demanded of us our being there, willing us to begone."[5]

Gabriel Archer, in 1607, speaks of the habitation of the "Great King Pawahtah," whose people gave us tobacco, which plant is referred to as among those grown by Powhatan.[6]

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[1] American Naturalist, XIII, p. 296.

[2] Antiquity of the Tobacco Pipe in Europe, American Antiquarian, II, p. 6.

[3] T. Studly and A. Todkell, Proceedings and Accidents with the First Supply in Virginia, p. 108, in Arber's edition of Smith's Works.

[4] Daniel Wilson, Prehistoric Annals of Scotland, IV, p. 504, London and Cambridge, 1863.

[5] G. Percy, A Discourse of the Plantation of the Southern Colony of Virginia, plate LXVI, in Arber's edition of Smith's Works.

[6] Gabriel Archer, A Relation of the Discovery of our River, p. xliii, in Arber's edition of Smith's Works.

Percy refers to an Indian pipe in 1607, which, he says, "was artificially made of earth, as ours are, but far bigger, with the bowl fashioned together with a piece of fine copper."[1]

An offering of tobacco was made to the English in 1607 at Dominico, within 14 degrees of the line, north latitude.[2]

It is difficult to understand what was intended by the expression "fashioned together with a piece of fine copper." Was it that the pipe had a bowl lined with copper, as is not uncommon with pipes of wood in the Northwest, or is the copper here referred to the tool with which the pipe was made?

An extremely interesting stone pipe is in the collection of the museum of the University of Pennsylvania, which was found at Chelsea, Massachusetts. About half an inch of the stone stem has been broken off. The piece has been replaced and is firmly held in position by a thin copper band about an inch wide, which is neatly fitted around the stem, reaching above and below the fracture and holding it in place.

Strachey refers to an offering of tobacco made to the expedition on the coast of Maine by "sixteen savages in three canoes;"[3] and an offering of a similar character was made in 1608 to John Smith by the Susquehannock Indians, at the head of Chesapeake Bay, of "bows and arrows and tobacco pipes." One of these Indians, Smith says, had "the head of a wolf hanging in a chain for a jewel, his tobacco pipe, three-quarters of a yard long, prettily carved with a bird, a deare, or some such devise at the great end, and sufficient to beat out one's braines, with bows, arrows, and clubs suitable to their greatness."[4]

Near the same place Smith encountered the Massowomekes, whose "targets, baskets, swords, tobacco pipes, platters, bows and arrows shewed they much excelled those of our parts, and their dexterity in their small boats, made of the barks of trees, sowed with bark and well luted with gum, argueth that they are seated upon some great water."[5]

These Massowomekes, the writer is informed by Mr. James Mooney, belonged to the Five Nations, people who commonly used birch bark, and whom we know were at that period living within touch of the French located on the St. Lawrence, or River of Canada, as it was then called, and who received their articles of metal directly from the French. Had the colonists followed the example of Smith and avoided the disputes and disagreements with which they were constantly burdened, they would have attained, as he has said, great happiness "had they

[1] G. Percy, A Discourse of the Plantation of the Southern Colony of Virginia by the English, Introduction, p. lxiv, in Arber's edition of Smith's Works.

[2] Idem, p. lxiv.

[3] William Strachey, Historie of Travaille into Virginia, p. 176 (Hakluyt Society).

[4] The Voyages and Discoveries of Capt. John Smith in Virginia, p. 350, in Arber's edition of Smith's Works.

[5] Idem, p. 367.

not so much doated on their tobacco, on whose fumish foundation there is small stability, there being so many good commodities besides."[1]

H. Spellman refers as early as 1609 to the pipe being used in the dance in Virginia. "They use," he says, "sports much like ours here in England, as their dancing, which is much like our Darbyshire hornpipe, a man first and then a woman, and so through them all, hanging all in a-round. There is one which stands in the midst with a pipe and a rattle, which, when he begins to make a noise, all the rest giggetts about, wrying their necks and stamping on the ground."[2]

This description of the dance of the Potomacs would apply to the dance of the Natchez on the Mississippi ten years earlier or to that of the Sioux of to-day.

Strachey describes "a clay the Indians call *assequeth*, whereof they make their tobacco pipes, which is more smooth and fyne than I have elsewhere seen any."[3] A note identifies this *assequeth* with catlinite, though the assertion does not appear warranted by the facts.

The natives of Maryland and those of the coast countries north and south of Maryland possessed a fine clay, from which pipes were made of a bright red color, examples of which coming under the writer's observation would justify Strachey's remarks. He considered the tobacco of Virginia in 1612 inferior to that of "Trinidado" or of "Orinoque," growing 2 or 3 yards from the ground, which the natives smoked, "stalk, leaves, and all, taking the same in pipes of earth, which very ingeniously they can make."[4] He also informs us that the unmarried Indian did not use tobacco.

Smith calls the tobacco pipe "pawpecones," while Strachey says it was "apokan."[5]

William Parker, in 1615, shows that the pipe was extended in hospitality by the Indian to his visitor, for "the first thing Powhatan did he offered me a pipe of tobacco, then asked how his brother, Sir Thomas Dall, did."[6]

The guild of tobacco-pipe makers was, according to Fairholt, incorporated October 5, 1619.[7]

By this time the cultivation of tobacco had become an extensive industry and the manufacture of pipes a regular trade. The arms of the tobacco-pipe makers' craft, which was displayed on all public occasions, was a growing tobacco plant, the private mark being on the heel

[1] John Smith, Advertisements for the Inexperienced, or the Pathway to Erect a Plantation, p. 95, in Arber's edition of Smith's Works.

[2] H. Spellman, Relation of Virginia, p. cxiv, 1609, in Arber's edition of Smith's Works.

[3] William Strachey, Historie of Travaille into Virginia, p. 32 (Hakluyt Society).

[4] Idem, pp. 121, 122.

[5] Idem, p. 44.

[6] William Parker's Recoverie from Among the Savages, R. Hamor, edited by Capt. John Smith, p. 518, in Arber's edition of Smith's Works.

[7] Tobacco and Its Associations, p. 166.

of the pipe in most cases. Sometimes a lily or a chicken was the conventional mark by which the ware or maker could be known in trade. For nearly three centuries Broseley, in England, has been one of the principal seats of the manufacture of pipes.[1]

Pritchett, in Ye Smokiana, illustrates a sturdy German smoking a pipe, taken from an illustration at Frankfort-on-the-Main, dated 1616,

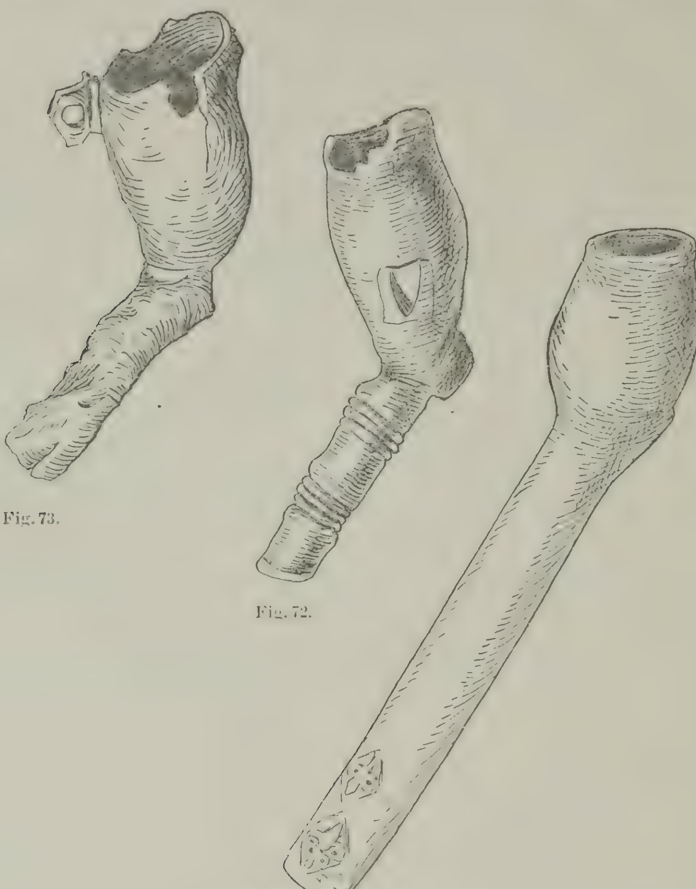

Fig. 73.

Fig. 72.

Fig. 71.

Figs. 71-73.

IRON, BRONZE, AND CLAY PIPES.

showing the smoker to be holding up the rectangular trade pipe, with his head thrown back as though he was smoking a tubular pipe, which would indicate that the practice at that period was novel.

Guda, near Rotterdam, Sevres, in France, and Dresden, in Germany, have been the sources of supply in their respective countries. "In the neighborhood of Bath (England) pipes were apparently made in the

[1] E. A. Barber, Antiquity of the Tobacco Pipe in Europe, American Antiquarian, II, p. 3.

beginning of the seventeenth century, and some of the examples bear a shield with a branch of the tobacco plant."[1]

Numbers of early English pipes are found in and near London, at times as much as 12 feet below the present surface of the ground, which were smoked with tobacco, and very likely other plants, in the plague of 1664 and 1665, which carried off so large a portion of the population of the city.

Opinions have differed as to the antiquity of the tobacco pipe in Europe, though at present the weight of authority would appear opposed to the belief of any pre-Columbian tobacco pipes. In figs. 71, 72, and 73 are presented three very primitive pipes, which, judging from the angle of the bowl with the stem, are as old as any form of English clay pipe which has come under the writer's observation. They are drawn after sketches furnished Dr. E. A. Barber by M. N. Cournault, of Malréville, near Nancy, France. Fig. 71, which is of clay, is in the National Library of Paris, and approaches closely the tubular form. The lily upon the stem would indicate a French origin. Of fig. 72 less can be said: its age would appear considerable, and it resembles a pipe figured by Baron Bonstetten, as from Roman ruins in Switzerland. It is made of bronze. Fig. 73 is an iron pipe from Meurthe et Moselle, in the collection of M. Hutton, who has a similar specimen from Camp de Châlons, Marne.

Fig. 74.
DUTCH FORM OF CLAY TRADE PIPE.
London, England.
Cat. No. 45585, U.S.N.M. Collected by E. Lovett.

Notwithstanding the finding of these bronze and iron pipes associated with remains of the Roman period,[2] the writer is inclined to doubt that they are of an antiquity as great as supposed, though many persons are of different opinion. These metal pipes differ too slightly to justify their being considered distinct from trade pipe forms.

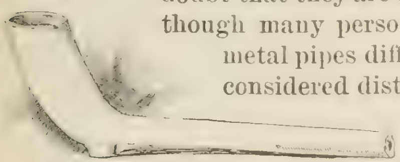

Fig. 75.
ENGLISH FORM OF TRADE PIPE.
London, England.
Cat. No. 129692, U.S.N.M. Collected by E. Lovett.

Fig. 74, here presented, was dug up in the environs of London, and is of a hard-burned white clay upon which the mold mark is quite distinct. Upon the upper outside rim of the bowl are seen a number of small dots in a row encircling the bowl, forming the mill mark. This circle of dots is found on the English molded pipes of the seventeenth century as well as on those of Dutch make. This bowl is quite small, holding less than one-half as much as fig. 75, also a pipe from ancient London. The cause of the reduction in the size of the bowl was probably owing to the restrictive legislation of the period of James I and the consequent enormously enhanced value of tobacco on account of its supposed wonderful medicinal virtues.

[1] Llewllynn Jewitt, Ceramic Art in Great Britain, I, p. 296, New York, 1878.

[2] Baron de Bonstetten, Recuiel d'Antiquités Suisses, Pt. 3, p. 13, Berne and Paris, 1855.

Fig. 76 is a molded pipe from Guda, Holland, collected by Mr. A. S. Gatschett, and has the same general style of bowl as the preceding English pipes, though in the latter the flat heel is observed instead of the spur. Upon the heel of this pipe are stamped five dots in a ring around a central dot. This variety is commonly described as one of the earliest English forms. Some attribute them even to the Elizabethan period.

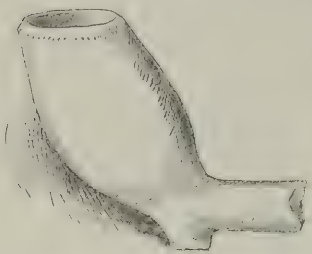

Fig. 76.

ENGLISH TYPE OF CLAY PIPE.

Guda, Holland.

Cat. No. 45959, U.S.N.M. Collected by A. S. Gatschett.

This stamp has been called by some writers a lily; by others it is described as a rose. So far, however, as the writer has been able to determine, it is extremely difficult to ascribe to these pipes any certain date, and there is doubt even whether the shape is not common alike to France, England, and Holland.

The trade marks and symbols on trade-pipe heels and bowls are too numerous to mention, though doubtless a study made of them would settle many vexed points in American archæology.

There is in the Douglass collection a pipe presented by Dr. Ferdinand Kellar, of Switzerland, and by him attributed to the sixteenth century, upon the side of the bowl of which are the same five dots in a circle referred to as being on the heel of the English pipe, and called a rose and also a lily, though the form of the pipe is more like those which in this paper are described as Iroquoian, the shape of which was mainly due to French influences. Upon one of the English pipes in the U. S. National Museum collection there appears the monogram HB on the heel.

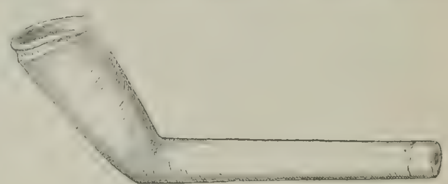

Fig. 77.

POTTERY TRADE PIPE.

Warren, Rhode Island.

Cat. No. 17974, U.S.N.M. Collected by J. H. Clark.

Fig. 78.

STEATITE TRADE PIPE.

Norfolk, Virginia.

Cat. No. 175595, U.S.N.M. Collected by J. D. McGuire.

Fig. 77 is quite an ancient English trade pipe, found in an Indian grave at Burs Hill, Warren, Rhode Island, and collected by Mr. J. H. Clark, upon which there is neither heel nor spur, though the mill mark around the outer side of the bowl is quite distinct. The texture of the pottery from which it is

made is much less hard than is usually the case with trade pipes, and it having no heel or spur may indicate that it was of a more primitive form than those having such.

Fig. 78 is a pipe in every way similar to the Rhode Island specimen, made, however, from dark green chlorite and well polished. It was given the writer some years since, and was said to be a surface find from near Norfolk, Virginia. The bowl and stem are as thin as are usually those of the molded trade type of burned clay, and it is a fine example of skill in stone work as well as an evidence of contemporaneous use of stone and clay pipes of similar form. Even though it were demonstrated that this pipe was made with steel tools, as it probably was, it would represent a piece of exceptionally good workmanship for a modern mechanic.

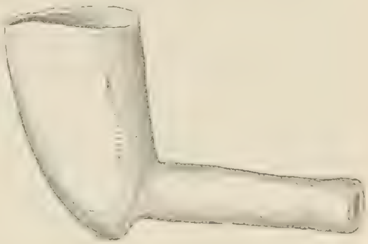

Fig. 79.
STONE PIPE.
Nacoochee, Georgia.
Cast, Cat. No. 31567, U.S.N.M. Collected by J. H. Nichols.

A cast of a stone pipe (fig. 79) found at Nacoochee, Georgia, collected by Mr. J. H. Nichols, is clearly of the type of the trade pipe. Its short stem and slightly enlarged mouthpiece, as well as the thinness of the bowl, would, however, appear to indicate a metal prototype and probable European origin.

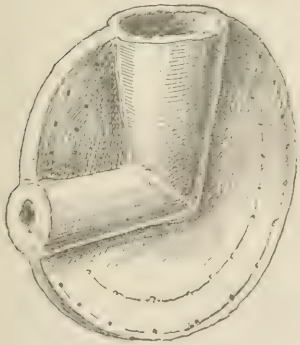

Fig. 80.
TYPE OF STONE TRADE PIPE.
Tioga, New York.
Cast, Cat. No. 58532, U.S.N.M. Collected by J. Allen.

Fig. 80 represents a cast of an extremely peculiar and unique specimen of the primitive trade pipe form, surrounded by a disk of stone evidently so carved and worked out of the stone as to resemble sewed leather. It is from Tioga County, New York, collected by Mr. J. Allen. While the dots encircling the pipe, representing the stitches of the needle, are upon the one side in two rows, there is but a single row on the opposite side; all are, however, connected by lines running from dot to dot, as though intended to indicate the thread. The pipe form and disk appear to suggest that it is made in imitation of a pipe in its leather case.

The next pipe (fig. 81), which also evidently belongs to the European type, is made from blue clay, and is said to be of the primitive Italian form. The bowl, at right angles to the stem, is very much larger than are any of the European pipes with which the writer is acquainted. It was found at Redbank, New Jersey, and collected by Mr. W. S. Vaux. The bowl rests upon three coils as a base, rudely ornamental, parallel

lines running closely up and down the same, beginning at the top of the coil and ending just below the upper edge of the rim. Pritchett, in Ye Smokiana, represents such a pipe as of Roman make of the date of 1669. Judging from the large size of this bowl, the type would probably be of a period when the price of tobacco was cheap, as was the case during the reign of Charles II. Pritchett appears to have copied his illustration from one of Benedetto Stella, which was published in Rome in 1669, and is by the latter referred to as of English make.

Fig. 81.
ITALIAN TYPE OF CLAY PIPE.
Red Bank, New Jersey.
Cat. No. 10032, U.S.N.M. Collected by W. S. Vaux.

As early as 1670 the Colony of Virginia shipped 12,000 hogsheads of tobacco, which was equal to 12,000,000 pounds.

Fig. 82 is a modern Dutch pipe made of the usual white clay, such as the ordinary clay pipe is commonly made from. It is figured solely for the purpose of illustrating the survival of primitive forms. The ornamentation is indicative of a close relationship to a class of pipes from Georgia herein referred to, and from this and other known specimens the deduction is quite natural that Europern traders in pipes usually catered in type and ornamentation to prevailing Indian forms, the ornamentation, with few exceptions, being due to European ideas. Pipes of this type were evidently intended to be smoked with hollow stems, probably made of reed. If the leaves surrounding the stem and radiating from the bird's beak and the beak itself are compared with those upon the pipes from the Etowah mound, and the mound pipes from Georgia, it will be admitted that they have a common origin, whether that be Dutch or Indian, and the mold mark on the Etowah specimen (fig. 238) suggests that it is European. Ornamentation very similar to the bird's beak appears to be employed in certain prettily modeled clay pipes found in Onondaga and Cayuga counties, New York, specimens of which are in the collection of the Peabody Academy of Sciences in Salem, Massachusetts; and an exceedingly fine specimen is also in the Douglass collection, the latter being about 7 inches long, and was found in Onondaga County, the beak arising 2½ inches above the bowl. It represents the head of a raven. The bird's mouth and nostrils are executed with unusual spirit, and appear to be due rather to French

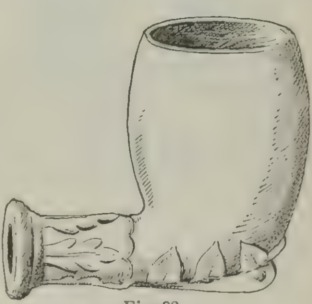

Fig. 82.
MODERN CLAY PIPE.
Holland.
Cat. No. 76856, U.S.N.M. Collected by U.S. State Department.

than Dutch or English influences. It may be argued that this resemblance between the pipes of the South and the North is due to accident rather than design, though the writer is convinced that in this case, as in most others of American pipes where artistic figures in the round are observed, the idea is European and due to European influences entirely.

The "trade pipe" goes by many names in different parts of the British possessions in Europe, "Danes pipes," "Cromwell pipes," "Elfin pipes," and "Celtic pipes" being among the most common. Wilson says that the pipes known by the last two names have been found in considerable numbers in North Berwick and elsewhere in Scotland.[1]

This pipe is quite common in many parts of Scotland. Some archæologists still contend that pipes of this type antedate the reign of Elizabeth, if not the discovery of America itself, a view in support of which there appears but little evidence.

One of the best known trade pipes was a London pipe which got its name from the "Old Cock Tavern." A rooster stamped on the heel identifies it.

The writer possesses a pipe of this type found in a shell heap on the shore of Chesapeake Bay, which has been so scraped over its entire surface so as to obliterate the mold mark. The attempt has been successful, except at one point on the heel, where a trace of it may still be seen. The stem of this specimen is only about 2 inches long and near the end is worn through on top by the smoker's teeth, which, if done by an Indian, must have been late in the seventeenth or early in the eighteenth century, for among primitive pipes there is seldom any evidence of the stem coming in contact with the teeth, and so marked is this that one is impressed with the belief that it must be due to some especial custom in connection with the pipe. A noticeable feature of this pipe is that the stem has been broken off close to the bowl and repaired with glue. This pipe was purchased of a lad who was smoking it at the time, and stated that he had found it less than half an hour before. As it was of undoubted trade form and the boy attached no value to it, there appears no reason to doubt the correctness of the story. That the pipe may, however, be that of a white man, as the wear of the stem would appear to indicate, must be admitted as a possibility, for Jewitt refers to "the bowls of many of the older pipes" which "are scraped into form after being molded."[2]

We can only surmise what the glue is with which this pipe has been repaired, as the only reference the writer recalls of aboriginal glue occurs in Smith's account of Virginia, in which he remarks that "with sinews and the tops of deers' horns boiled to a jelly they make a glue that will not dissolve in cold water."[3]

[1] Daniel Wilson, Archæology and Prehistoric Annals of Scotland, p. 679, Edinburgh, 1851.

[2] Llewellynn Jewitt, Ceramic Art in Great Britain, I, p. 295, New York, 1878.

[3] Capt. John Smith in Virginia, p. 68, in Arber's edition of Smith's Works.

Whether the original trade pipe is a copy of an earlier stone pipe or not may be open to question, the writer being of the impression that it is a modification of the primitive tube. Mr. Newton D. Sprecher, however, found on the Upper Potomac River, near Shepherdstown, in Virginia, a very perfect specimen of a stone pipe of the "trade type," the stem of which is somewhat large in proportion to the size of the bowl. It appears to be made of banded slate.

While the Indian, we are told, would give anything in his possession for tobacco, and made many and sometimes singular uses of it, it remained for the whites to adopt it as currency. The first evidence of which that has come under the writer's notice is an enactment at James City, Virginia, in 1619, declaring tobacco a currency, the treasurer of the colony being directed to receive it at a valuation of 3 shillings a pound for the best and 18 pence a pound for the second quality.[1]

Governor Yeardley directed general attention to the culture of tobacco, the profits of which became so alluring that all other occupations were forsaken for it. In the colony of Virginia, with a population of 4,000 in 1620, 40 hogsheads of tobacco were shipped to England; in 1638, 500,000 pounds, and in 1670 it had increased to 12,000,000 pounds.[2]

During the reign of Elizabeth there was no especial reason for a small bowl to the pipe, except the natural scarcity of the tobacco supply, the duty on it being only 2 pence a pound. James I, however, raised it to the enormous sum of 6½ shillings a pound.[3]

From this time on for a long period the strongest efforts were made to suppress the use of tobacco. The same year (1620) that the colony of Virginia exported 40 hogsheads of tobacco King James I issued a proclamation for restraint of disorderly trading of tobacco. "Whereas," says the statute, "We, etc., out of the dislike we had to the use of tobacco, tending to a general and new corruption, both of men's bodies and manners, and yet, nevertheless, holding it of the two more tolerable that the same should be imported, amongst many other vanities and superfluities which came from beyond the seas, then permitted to be planted here within this realm, thereby to abuse and misemploy the soil of this fruitful Kingdom" * * * did prohibit, after the 2d day of February, (then) next "the sowing, setting, or planting of tobacco; and whereas we have taken into consideration the great waste and consumption of the wealth of our Kingdoms by the inordinate liberty and abuse of tobacco, being a weed of no necessary use, and but of late years brought into our dominions,"[4] it prohibits others than such as shall be authorized and appointed thereto by letters patent from having it in possession, etc.

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[1] Justin Winsor, Narrative and Critical History of America, III, p. 143.

[2] Idem, pp. 140, 146, 147.

[3] F. W. Fairholt, Tobacco and its Associations, p. 83.

[4] Robert Sanderson, Rymeri Fœdera, p. 233, London, 1726, quoting Eighteenth, James I.

Charles I, in 1625, issued a proclamation "De herba nicotiana," in which the following appears: "Whereas our most dear father did, 29th September last and the 2d of March last, publish two proclamations prohibiting the importation of tobacco not the growth of Virginia or the Sommer Islands," gives until the "fowerth daye" of May next to export any such as may be in the country.[1]

So drastic a measure as to require the exportation from England of tobacco not grown in the British possessions appears to have been the cause, in some way, of a proclamation issued the following year (1626) allowing the importation into England of 50,000 pounds of Spanish or foreign tobacco.[2]

When the demand for tobacco exceeded the supply, the natural law of trade immediately became in force, and the price increased in proportion. At one period it was related that the newest and least worn shillings were laid aside with which to purchase an equal weight of the *Herba nicotiana*.

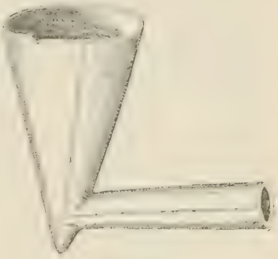

Fig. 83.

BRAZED IRON PIPE.

Cherokee County, North Carolina.

Cat. No. [illegible], U.S.N.M. Collected by Gen. Thomas [illegible].

In 1626, it is said, "Sir Henry Oglander, in the Isle of Wight, records for eight ounces of tobacco 5 shillings," and in the Journal of Rev. Giles Moore, in 1656, he notes "for two ounces of tobacco 1 shilling."[3] This enormous cost of tobacco would naturally have a tendency to reduce the pipe bowl to "elfin" dimensions.

To what extent the colonists smoked in the earlier years we appear to have no record, but from certain remarks encountered in some colonial writings we can but infer that they indulged in smoking to a less extent than Englishmen did at home. The restrictive legislation of the mother country against smoking was also enacted in some of the colonies, and the writer is of the impression that the law against smoking in the public streets yet prevails upon the statute books, applying to Boston, Massachusetts, and survives from the laws of the seventeenth century. The tobacco pipe of the famous Miles Standish, who came over in the *Mayflower*, and which was smoked by him on the day of his death, is referred to as a little iron affair about the size and shape of a common clay pipe,[4] probably just such an iron pipe as is often found in European countries and commonly, but erroneously, the writer thinks, attributed to the Roman period.

A very primitive yet a substantial metal pipe (fig. 83) from Cherokee

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[1] Robert Sanderson, Rymeri Fœdera, p. 19, quoting First Charles I.

[2] Idem, p. 849.

[3] F. W. Fairholt, Tobacco and its Associations, p. 104, London, 1859.

[4] Antiquity of the Tobacco Pipe in Europe, referring to the Albany Journal, American Antiquarian, II, p. 6.

County, North Carolina, collected by Gen. Thomas A. Duncan, is said to have been found in an old shaft supposed to have been one of the workings of De Soto in that State. The cone-shaped bowl is at right angles to its tubular stem, both bowl and stem being made of sheet wrought iron cut to the desired size, the edges of which when brought together have been neatly brazed, the brass line being well shown in the illustration. The writer would suspect a much more recent period than that of De Soto as the date of this pipe, and either French or English as its origin, probably the latter.

This view is greatly strenghtened by fig. 84, a steatite pipe from Westerly, Rhode Island, collected by Mr. J. H. Clark. The bowls of these two pipes, except in material, are identical, and the stone specimen leaves little doubt of its being a copy of a metal original. The walls of bowl and stem are approximately three-sixteenths of an inch thick, a glance at which suggests a metal rather than clay prototype.

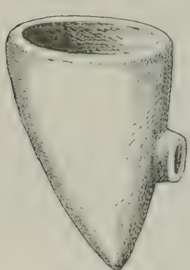

Fig. 84.

STONE PIPE.

Westerly, Rhode Island.

Cat. No. 17951, U.S.N.M. Collected by J. H. Clark.

A still more primitive metal pipe than any we have encountered is a specimen catalogued as from "Virginia," in the museum of the University of Pennsylvania, which is about 8 inches long, made from a thin sheet of copper, in shape somewhat like that of the trade pipe. The copper had first been cut to suit the purpose for which it was intended; the stem has been formed by hammering the edges into tubular shape and then made to overlap; the bowl, at right angles to the stem, has been hammered in the same way, the sheet forming it also overlapping, as did the stem. The only sign of ornament on this very primitive pipe is a narrow beading projecting around the upper edge of the bowl, hammered from the inside. The metal from which this pipe is made is neither welded, brazed, nor riveted, yet the overlapping metal forms a most satisfactory stem and bowl.

Still another metal pipe made of sheet copper was plowed up in a field at Mount Eaton, Stark County, Ohio, and is in the Douglass collection. It is of thin sheet, the bowl and stem both being brazed.

From the period of the first use of tobacco in Europe, so far as the writer has observed, the shape of the trade pipe has remained practically constant, the European having apparently adopted a pipe of a shape selected by the early traders with the Indians.

Among the American Indians there are known to have been many different plants smoked in pipes; and while the European appears to have been generally consistent in his employment of tobacco there were exceptions to the rule, a most peculiar one of which was that recorded of William Bredon, who in 1633 was the parson or vicar of Thornton, "who was so given to tobacco and drink that when he had no tobacco he would cut the bell ropes and smoke them."[1]

[1] F. W. Fairholt, Tobacco and its Associations, p. 107, quoting Lilly the astrologer.

The English were trading in axes, blue cloth and peake, jew's-harps, pipes, etc., according to the records of proceedings in the Council of Maryland in 1637, and had, presumably, done so in Virginia from an earlier period. Among articles seized under a sheriff's levy on the goods of Captain Cleyborne, June 20, 1638, are enumerated, "two trading pipes." Josselyn asserts that tobacco derives its name from Tabago, one of the "Caribbe Islands," and refers to its proper name as "picielte, as others will Petum; nicotian from Nicot, a Portugal," and quaintly refers to its being "made the complement of our entertainments and hath made more slaves than Mahomet."[1]

After the middle of the seventeenth century the English constantly refer to the pipe in trade with the Indians and in the presents given in treaties and councils. At first they are enumerated in small quantities, but soon are treated of by the gross. The colonists cultivated the tobacco plant, and early turned out by machinery pipes in which to smoke it, all which added to their trade and its consequent profits.

Among the articles enumerated which were given in exchange for land lying between Rankokas Creek and Timber Creek in New Jersey, on September 10, 1677, are 120 pipes and 100 jew's-harps.[2]

Five years later William Penn landed and received the lighted calumet or pipe, "which was smoked out of by all, the great sachem first taking a whiff, then William Penn, and subsequently the sachems and warriors and squaws of every tribe."[3] A second smoke closed the bargain for the purchase of the land; and 300 tobacco pipes, 100 hands of tobacco, 20 tobacco boxes, and 100 jew's-harps were a portion of the articles given in the exchange.

Garcillasso de la Vega, in his Royal Commentaries of Peru, 1688, gives so little information concerning tobacco beyond mentioning its name, "sayri," as to leave one under the impression that it was not smoked by the natives; it was, however, used as snuff.

In the "Counterblaste" of King James I, tobacco is spoken of as "loathsome to the eye, hurtful to the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fume thereof nearest resembling the horrible stygian smoke of the pit that is bottomless."[4]

English pipes presented to the Indians in 1692 were of wood and tin, others were referred to as "wampum pipes," and others as of "white clay."[5]

In the negotiations in 1702 by Lord Combary, captain-general and governor in chief "to ye farr Indians called 'Twightwighs' (Miamis)

[1] Collections of the Massachusetts Historical Society, 3d ser., p. 261, Josselyn's account of Two Voyages to New England.

[2] Samuel Smith, History of the Colony of Nova Caesaria, or New Jersey, Burlington, New Jersey, 1765.

[3] M. L. Weems, The Life of William Penn, Philadelphia, 1836.

[4] R. A. Brock, The position tobacco has ever held as the chief source of wealth to Virginia, p. 11, Richmond, Virginia.

[5] W. M. Beauchamp, Indian Pipes, American Antiquarian, IV, p. 329.

and 'Dionondades'" (Wyandots and Nation de Petun), among the presents to the Indians "one hundred and ten wampum pipes"[1] are mentioned, referring probably to the hard-burned trade pipes.

Labat, in 1724, says tobacco was like an apple of discord which lighted up a lively war among the learned, in the discussions concerning which the ignorant took an equal part; even the women were not backward in arraying themselves for or against a thing they understood no more than they did the serious problems of their times. Doctors, he says, took advantage of the occasion, though they had never before seen or heard of tobacco, and did not hesitate to discuss its virtues as though they had known it since the time of Galen, Hippocrates, and Esculapius. Reasoning without knowledge, they seldom agreed; some tempered it with cooling drugs, others mixed it with aromatic herbs, but all concurred in prescribing it with directions how to prepare and take it according to age, strength, and temperament. They prescribed the exact quantity to be taken, and at what time; one was to take it fasting and another only after a meal; one in the evening and the other in the morning, etc.[2]

The natives of the Hudson Bay country received from the English traders "medicines" analogous to the tobacco of America, according to Ellis, in 1750, who says: "There are many, especially those living on the cliffs of the Great Lakes in the interior of the country, who act the rôle of charlatans, with drugs they buy of the English—sugar, ginger, barley, pepper, the seeds of kitchen plants, Spanish liquorice, powdered tobacco, etc. The Indians take all these drugs in small quantities, either as remedies, or that they may excel in hunting, fishing, or in fighting; qualities attributed to these trifles by the Hudson Bay English. It is by these means that a third of the trade is made with these charlatans who exchange them for furs which the common people give them or which they trap."[3] De Paw says: "Sarmiento in going for reenforcements for his settlements was made prisoner by this celebrated Raleigh, who on his part had sought El Dorado, and who was afterwards beheaded at London for having taught the English to smoke, at least the judges alleged this pretext to immolate a great man whom they disliked. If it is true that England gains annually twenty millions from this American plant it is surprising that Raleigh has not yet a statue."[4]

At Damariscotta River, Moscougas Sound, Maine, Mr. Phelps has repeatedly found iron implements and clay pipes of European make in the upper layers of the great shell heap, but in no case have these things been found below 1 foot from the surface.[5]

[1] Documents relating to the Colonial History of New York, IV, p. 981.

[2] Labat, Voyages aux isles de l'Amerique, IV, p. 479, Hague, 1724.

[3] Henry Ellis, Voyage à La Baye de Hudson, p. 246, Leyden, 1750.

[4] Cornelius De Paw, Recherches Philosophiques sur les Américains, I, p. 361, London, 1771.

[5] F. W. Putnam, Sixteenth and Seventeenth Annual Report of the Peabody Museum of Archæology and Ethnology, pp. 161, 353.

There is in the collection of the U. S. National Museum (Cat. No. 6182) a fragment of a pipe made of blue clay which was found at Bloomfield, Onondaga County, New York, collected by Col. E. Jewett. It is poorly burned, yet quite artistic in design, the attempt having apparently been made to imitate an ear of corn on the panels surrounding the bowl. That its origin is due to the white people is further shown by a stamp of a notched arrow fitted into the string of a bow, which is drawn back to its head, this is placed inside a diamond-shaped figure. The specimen apparently belonged to a pipe of the type of the Roman specimen found at Red Bank, New Jersey. The Rev. W. M. Beauchamp refers in a private letter to a pewter pipe found in Oneida County, New York, of the "trade pipe" form, and speaks of others of brass and iron. Dr. E. A. Barber also refers to a pipe of the "trade pipe" pattern which was found in the Jura Mountains, Canton of Berne, Switzerland, made of iron, having upon its bowl the face of a man facing the smoker, and a second face on the far side facing in the opposite direction, and a second specimen, on the bowl of which there is represented the leaf of some plant, probably a tobacco leaf.

In a communication to the Daily Post of Birmingham, England, by Mr. Este, he refers to "pipes of Sevres, of Saxe, and Berlin; Capo di Monte and Furstenburg, Copenhagen; English pottery, Worcester glazed pipes of Brompton ware and Wedgewood; Italian pipes of delicate ivory and choicest Venetian glass; German pipes of agate and meerschaum; Swedish pipes of iron from Danemora, and Roman pipes from the Campagna," as among the celebrated pipes of the world.[1]

These and those of many other countries were among the pipes in the wonderful Bragge collection now in the British Museum. On the Indian town sites of the Colonial period fragments of many of these pipes at times occur, especially those of the Spanish, French, Dutch, English, and Italian types. Among the French pipes of the beginning of this century Fairholt figures one, part of the stem of which consists of a cannon having upon the barrel two bowls, one behind the other, in shape of bombshells. The idea is identical with the double-bowled Siouan callinite pipe herein figured[2] (fig. 176).

A similar specimen has been found in a mound in Michigan. There are doubtless those who will consider the latter type purely aboriginal, though the writer can not help thinking that the form is due to the influence of European art. The same may be said of the death's-head pipe, not uncommon on the continent of Europe, which has characteristics similar to those of certain pipes of the Iroquoian type found along the St. Lawrence, in northern New York. An inquiry among distinguished archaeologists of France, Italy, and Holland as to the primitive forms of pipes of those countries has had only negative results. Ancient stone pipes appear scarcely ever in Europe, the only one coming under the writer's notice being referred to by Wilson as coming from

[1] The Pipes of All People, Birmingham Daily Post, December 16, 1870.

[2] F. W. Fairholt, Tobacco and its Associations, p. 188, London, 1859.

the village of Morningside, at the base of the Pentland Hills, in Scotland, where numerous traces of primitive population have been brought to light.[1]

Dr. E. A. Barber refers to a pipe of Etruscan origin, having a beautiful patina, in the Campagna collection, which presents some characteristics of originality, yet Rev. W. M. Beauchamp refers to a specimen of quite similar type in his collection at Tompkinsville, New York which was found on the shore of the Susquehanna River.

It is to be regretted that the history of the tomahawk pipe is so incomplete in early American writings, for it certainly has occupied as important a place, both in war and peace, over a great part of the continent as any pipe known, and is peculiarly a war pipe and one of the most familiar and terrible weapons of the allies of the whites in the endless colonial wars of America. According to Strachey the native term for "hatchet" was "taccahacan," or "tamahaac," as distinguished from an Indian hatchet, which was "cunsenagwas."[2]

This word eventually came to designate the "war hatchet" of the Indian, supplied by the military commanders of the whole continent in equipping the warriors on the many expeditions in which French and English were constantly engaged, and was furnished the Indian allies of the English in our war of Independence. This weapon was either in the form of a spear or hatchet blade on one side, while upon the opposite side there was a cup-like cavity with a small hole extending into the eye of the weapon into which a tough handle of wood was fitted, 18 inches or 2 feet in length. The handle was perforated almost its entire length, and below the hollow of the bowl it was bored at right angles to this perforation, a suitable stem hole for the passage of the tobacco smoke when the implement was in use as a pipe. The tomahawk pipe was not only attractive and popular in trade, but, like the earlier trade pipe, was given as a present at councils and ratifications of treaties; it was a pipe, a hatchet, and a mace or hammer all in one, and answered an important military requirement in lessening the weight and incumbrances of the warrior, who otherwise would have tenaciously held to the stone pipe, which, in itself, was heavier than the tomahawk. French, English, and Spanish all appear to have made and distributed the metal tomahawk. Usually it was of iron, but examples are known of copper, of brass, and of pewter. Some were made of a combination of brass and iron, intended for ornamentation rather than to add to its effectiveness. At times the blades were inlaid with silver in ornamental designs. The outline of the bladed tomahawk of metal is so similar to the stone hammer-ax or Thor-hammer of antiquity as to suggest that the one was copied from the other. The handles of these tomahawks were from an inch to 1½ inches in diameter, the stems of them when not bored were split open,

[1] Daniel Wilson, Archæology and Annals of Scotland, p. 681, Edinburgh, 1851.

[2] William Strachey, Historie of Travaille into Virginia, 1612 (Hakluyt Society).

and, having a groove gouged in each piece, they would be again placed together and held in place with glue, or bound with wire or hide. The ornamentation of pipe stems depended largely upon the owner's taste, they being decorated in the most attractive manner; sometimes the ornamentation would be of feathers, of strips of skins of various animals, or they would be studded with brass or silver nails, and scores or tallies were often kept by notches, representing the enemies killed or struck with the weapon. The writer recalls a Creek tomahawk hatchet pipe upon the handle of which were several groups of score marks said to represent the victims of its owner's prowess, the different scores indicating distinct tribes with which the owner had fought.

Fig. 85.
ENGLISH TYPE OF TOMAHAWK PIPE.
Cat. No. 3233, U.S.N.M.

Fig. 85 is one of the most graceful and at the same time most symmetrical of the familiar forms of the English tomahawk pipes. Its long graceful hatchet blade is made of iron, into the blade of which is inlaid an ornamented silver plate in the form of the now familiar Bowie knife, upon the blade of which is neatly engraved "H. Knox," as though a play upon words were intended. The handle of this pipe-hatchet has wound around it a band of silver, and a number of silver nails driven into the wood. This tomahawk is 8 inches from edge of the blade to the top of its bowl. There is in the U. S. National Museum collection a similarly shaped specimen from Cattaraugus County, New York, with a blade of brass into which is brazed a steel cutting-edge. On these tomahawks the bowls are similar, shaped like an inverted acorn, having the general characteristics of the Micmac stone pipe. There is in the collection of the U. S. National Museum another tomahawk-shaped pipe of wood, of Cherokee make, the bowl and eye of which are, however, reenforced by a lining of sheet iron. The earliest description the writer has found to tomahawks is that of Robert Rogers, who, in 1765, says: "This weapon," the tomahawk, "is formed much like an hatchet, having a long stem or handle; the head is a round ball of solid wood, well enough calculated to knock men's brains out, which on the other side of the stem terminates in a point where the edge would be if made an hatchet, which point is set a little hooking or coming towards

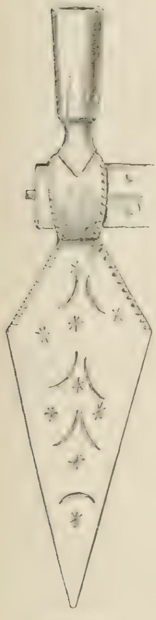

Fig. 86.
TOMAHAWK PIPE.
Devils Lake, Dakota.
Cat. No. 23728, U.S.N.M.
Collected by Paul Beckwith.

the stem; and near the center where the stem or handle pierces the head another point projects forward a considerable length, which serves to thrust with, like a spear or pike pole. The tomahawk is likewise ornamented with feathers and paintings disposed and variegated in many forms, according to the occasion and end for which it is used, and on it they keep journals of their marches and most important and noted occurrences in a kind of hieroglyphs."[1]

The description of Rogers would therefore indicate that the tomahawk pipe was not in general use ten years prior to the Revolution but about contemporaneous with the war of the Revolution.

Fig. 87.
FRENCH TYPE OF TOMAHAWK PIPE.
Kiowa Indians.
Cat. No. 153013, U.S.N.M.
Collected by James Mooney.

Fig. 86, from Minniwaukan or Devils Lake, Dakota, collected by Maj. Paul Beckwith, United States Indian Agent, presents the tomahawk pipe with the spear-shaped blade. The ornamentation of this blade is quite gracefully arranged by incisions in the metal in conventional star and crescent-like figures and notches on the upper angles of the spear and around the edges of the eye. The bowl, while longer, is less ornamental than that of the preceding figure. This type is commonly attributed to the French, but with little apparent authority, though the presumption may well be correct, for we know that pipes, from their shape and ornamentation, were attributable to their proper tribe, and it is most natural that English and French should have armed their allies in such a manner as to render them easily distinguishable from their enemies. Had the tomahawk pipe been employed in Rogers's time he would scarcely have failed to notice it, one would think, though, Col. A. Lane Fox, quoted by Stevens, says, that "during the American war the English were compelled to make iron tomahawks after the native pattern with a pipe bowl opposite the blade of the weapon, before the Indians could be efficiently armed as allies."[2] This would probably identify sufficiently the time when these weapons came into general use as about the beginning of the Revolution. They have been referred to as instruments "resembling a little axe with which the Indians crush the heads of their enemies, which they smoke, and on the handle of which they keep a register of their victories."[3]

Closely allied to the last specimen is one (fig. 87) collected among the Kiowa by Mr. James Mooney. Though the head is only $6\frac{3}{4}$ inches long,

[1] Robert Rogers, A Concise Account of North America, p. 226, London, 1722.

[2] Edward T. Stevens, Flint Chips, p. 526, London, 1870, quoting Col. A. Lane Fox. Primitive Warfare, Journal of the Royal United Service Institute, XI, p. 617.

[3] John Filson, Histoire de Kentucke, nouvelle Colonie à l'Ouest de la Virginie, p. 97, note, Paris, 1785, translated from English by M. Parrand.

the handle of it is 20 inches long. Mr. Mooney, who has passed much time among the natives of the Southwestern portion of the United States, attributes this specimen to the Mexican or Spanish type: a somewhat similar specimen (Cat. No. 8363, U.S.N.M.), collected among the Apaches, would appear to sustain this opinion, the pipe figured retaining very greatly the pike or halberd shape which was in use in the eighteenth century.

The form of the old metal battle axe is preserved in fig. 88, which is an iron tomahawk, found in Greenbrier County, West Virginia, by Mr. W. R. Stewart. The axe is 7 inches long, its blade being perforated with three holes for the purpose of allowing the attachment of cloth or feather ornaments; brass disks, slightly convex, are brazed to the blade to heighten the effect from an esthetic point of view. This curved blade may be seen in many weapons in the collection of the U. S. National Museum recently brought from the Kongo, as well as in the battle-axe of the time of the Crusades.

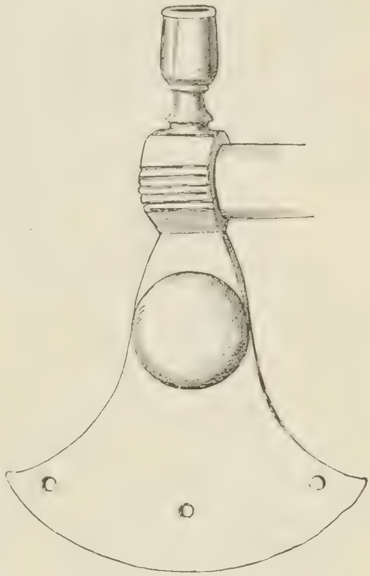

Fig. 88.

SPANISH TYPE OF TOMAHAWK PIPE.

Greenbrier County, West Virginia.

Cat. No. 13515, U.S.N.M. Collected by W. R. Stewart.

There is in the collection of the Museum of the University of Pennsylvania an excellent bronze tomahawk pipe from Pasadena, California, the exterior of which, blade, bowl, and eye, are all covered with series of short straight and curved lines arranged in tasteful designs.

In the Siouan area, near the waters of the Upper Missouri, tomahawks in imitation of those made of metal are found made of catlinite.

Pipes of this character, owing to the Indians' being moved on to reservations from their original homes, are liable to be found far from their original point of distribution, and while the same argument would apply to pipes of other shapes it would be to a far less extent for many reasons, chief of which would be that the earlier Indians were confined within more restricted limits.

There was, there can be little doubt, a more intimate acquaintance of the whites with the interior of the continent, through the wanderings of hunters and traders, than is generally believed. That the goods of the whites were traded from tribe to tribe before the whites themselves penetrated the country is recorded. James McBride, according to Filson, was the first white man who had knowledge of Kentucky, and, in 1754, "accompanied by some friends, descended the Ohio in

canoes, disembarked at the mouth of the Kentucky, and marked three trees with the first letters of his name."[1]

Du Pratz, however, it should be remembered, in 1758, only four years subsequent to this supposed visit, published a map of parts of the interior of the continent, upon which the Miami and the Maumee, the latter under the name of the Riviere du Portage, are both laid down.[2]

It is known that not only did the individual trader or trapper try to keep his rivals in ignorance of the territories which he visited, but the matter was an international one as well, for Spanish, French, English, and Dutch each tried to deceive those of other nationalities concerning the interior or back country, the struggle then, as in some countries even now, being to obtain or retain exclusive trade privileges. We see the same struggle to-day in Africa between the French and English which two hundred years ago was carried on in America.

In 1778 Daniel Boone was taken prisoner by 200 Indians and two Frenchmen, who carried him to the salt mines, where he found 27 more of his party, whom he regularly surrendered. "The advantageous conditions of his surrender," he says, "they observed strictly."[3]

MONITOR PIPES.

There is no pipe more striking or better marked in its characteristics than the "Monitor," which is widely distributed in the eastern United States, it being often found in mounds and other primitive burial places. This pipe is constantly encountered and has upon its surface the distinct striæ of the steel tools with which it was made, leaving little doubt that it was a common form after the advent of the whites. The delicacy of its finish as well as of its outline is surpassed by no American pipe, though this type does not appear to be found having upon it representations of animal life in any form, rarely ornamentation of any sort. The material from which they were usually, though not invariably, made is a chlorite or steatite and sometimes serpentine, though rarely the latter, and specimens having certain of the characteristics of this type are known which are made of pottery. They vary in color from nearly white to jet black, being usually highly polished and have remarkably thin bowls.

Adair, in 1775, refers possibly to a pipe of this character. He says: "The Indians make beautiful stone pipes, and the Cherokees the best of any of the Indians, for their mountainous country contains many sorts and colors of soil proper for such uses. They easily form them with their tomahawks, and afterwards finish them in any desired form with their knives; the pipes being of a very soft quality until they are smoked with and used to the fire when they become quite hard. They

[1] John Filson, Histoire de Kentucke, nouvelle Colonie à l'Ouest de la Virginie, I, translated from English by M. Parrand, Paris, 1785.

[2] Le Page Du Pratz, Histoire de la Louisianne, map opposite p. 138, Paris, 1758.

[3] Histoire de Kentucke, pp. 75, 76, Paris, 1785.

are often fully a span long, and the bowls are about half as large again as our English pipes. The fore part of each commonly runs out with a peak two or three fingers broad and a quarter of an inch thick on both sides of the bowl; lengthwise they cut several pictures with a great deal of skill and labor, such as a buffalo and a panther on opposite sides of the bowl, a rabbit and a fox. The savages work so slow that one of their artists is two months at a pipe with his knife before he finishes it; indeed, as before observed, they are great enemies of profuse sweating and are never in a hurry about a good thing. The stems are commonly made of soft wood, about 2 feet long and an inch thick, cut into four squares each, scooped till they join very near the hollow of the stem; the beaux always hollow the squares except a little at each corner to hold them together, to which they fasten a parcel of bell buttons, different sorts of fine feathers, and several small battered pieces of copper kettles, hammered, round deerskin thongs, and a red painted scalp. They so accurately paint hieroglyphic characters on the stem that all the war actions and the tribe of the owner and a great many circumstances of things are fully delineated."[1]

Fig. 89.
MONITOR PIPE.
Milford, Massachusetts.
Cat. No. 17946, U.S.N.M. Collected by J. H. Clark.

The monitor pipe is one upon which more care has been expended in boring its bowl and stem and in grinding and polishing the surface than any other type of pipe on the continent, not excepting the famous mound pipes. They vary in length from 3 to 18 inches with bases from 1 to 4 inches wide, the bowls varying from 1 to 8 inches in depth with a diameter of from three-fourths of an inch to $1\frac{3}{4}$ inches, usually cylindrical, though at times distinctly elliptical; they appear to have been smoked without separate stem. The stem holes seldom exceed one-eighth of an inch in diameter and are bored with remarkable accuracy, the variation of the size of the stem hole from end to end being scarcely appreciable. This remarkable accuracy of boring in stone where the walls of the tubes and bowls are commonly not in excess of one-eighth of an inch thick is almost proof positive that the drilling was done with steel tools.

The most primitive specimen of the monitor type (fig. 89) is from Milford, Massachusetts, collected by Mr. J. H. Clark. It has a bowl of oblong cross section, at the base of which is a slight heel, suggestive of the primitive European pipe; the cross section of the stem is a flattened ellipsoid, but slightly out of the plane of the bowl. This bowl is rudely scratched, as is the stem, the striæ crossing and recrossing over the

[1] History of the North American Indians, particularly those natives adjoining the Mississippi, east and west Florida, Georgia, North and South Carolina, and Virginia, p. 423, London, 1775.

whole surface. Stems of this type usually project beyond the bowl and broaden out on each side of it to a greater or less distance. The outline of these pipes is at times strikingly similar to the form of the monitor vessel of the civil war. On the upper side of the stem of a pipe of this character in the collection of the U. S. National Museum from Chester County, South Carolina, occurs three straight lines cut through the

Fig. 90.
MONITOR PIPE.
Sullivan County, Tennessee.
Cat. No. 82390, U.S.N.M. Collected by J. W. Powell.

surface in the form of a parallelogram open on the side next the mouthpiece. A pipe of this type was also found on York River, Virginia, and is in the collection of Col. William H. Love, of Baltimore, Maryland.

A very similar specimen about 7 inches long, but without the heel, is here given, after Mr. Gerard Fowke (fig. 90), collected by Maj. J. W. Powell in Sullivan County, Tennessee. It was found in a burial mound and is of black chlorite. It has an alate stem, so common in pipes of this character. The largest specimen of this type so far encountered is probably a "Great pipe," having a bowl 8 inches long, being upward of 17 inches in total length, which was found in a mound in Marion County, Kentucky, collected by Mr. William T. Knott. This pipe is finished so delicately and carefully that over its whole surface there does not remain a single mark from the tools with which it was made. The smoothness of the surface is such and the bowl and stem are so thin that it would require unusual care to duplicate it with any tools with which it may have been made. In pipes of this type there is almost invariably a pronounced ridge running the length of the center of the stem, and so marked is this as to suggest a ductile prototype, either of pottery or metal.

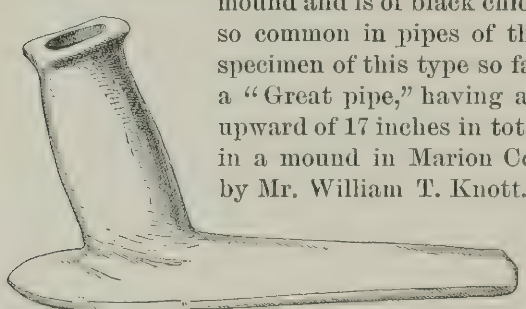

Fig. 91.
MONITOR PIPE.
Caldwell County, North Carolina.
Cat. No. 83037, U.S.N.M. Collected by J. P. Rogan.

Fig. 91 is a pipe from Caldwell County, North Carolina, collected by

Mr. J. P. Rogan. It is of chlorite, and has an extreme length of 5 inches, with a width of stem of 1½ inches. The flaring top, and the bowl, which approaches the rectangular, indicate no other than most primitive tools in working the surface, though even here there can be little doubt that metal was employed in boring both the bowl and the stem. The flaring top commonly noticeable in pipes of this type does not appear to have reached its limit except in those specimens where bowl and stem are at right angles to each other.

Fig. 92.

FLAT-BASE MONITOR PIPE.

Cumberland County, Tennessee.

Cat. No. 20130, U.S.N.M. Collected by S. D. Hoskins.

A very dark, almost black, "monitor" (fig. 92) is from Cumberland County, Tennessee, collected by Mr. S. D. Hoskins. It has a flat base 3 inches wide, though its height is little over 2½ inches. The stem at its thickest is slightly more than one-fourth of an inch, while the barrel-shaped bowl, with its wide and thin flaring top, have all been highly polished. The bowl cavity has been enlarged by gouging.

Professor Haldeman possesses a somewhat similar specimen, though without the enlargement of the rim of the bowl, from York County, Pennsylvania, which is well polished and made from a green stone.

A brownish steatite from Michigan, collected by Mr. D. S. Carvin, in shape almost identical with the last specimen (fig. 93), was found in a mound in Kanawha County, West Virginia, with a number of copper bracelets and objects of stone. Under the flaring top of this specimen are the file marks, too distinct to leave any doubt that it was with such a tool that they were made. They radiate from the inner to the outer rim, in series of parallel straight lines, and are equally distinct at the base of the bowl.

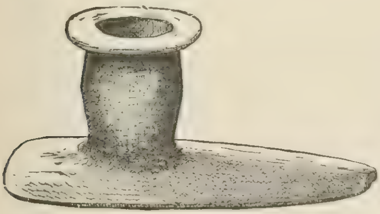

Fig. 93.

MONITOR PIPE.

Kanawha County, West Virginia.

U. S. National Museum. Collected by D. S. Carvin.

The most pronounced and typical "monitor" pipe is fig. 94, from Knox County, Tennessee, collected by Mr. J. W. Emmert. The projection of the base is as pronounced in front of the bowl as it is at the stem end. The barrel shape of this bowl has great similarity to certain of the urn-shaped bowl pipes. In this, as in the last specimen, the file marks are observed at the exterior base of the bowl where it joins the stem. They also appear under the flaring top of the bowl with great distinctness. This pipe is made of a light gray chlorite, and is, as a mechanical production, quite a marvelous piece of work.

Fig. 95 is a brownish gray specimen made of oolitic limestone, and was found in a mound near the ancient city of Kanahwa, West Virginia. It was collected by Mr. J. W. Norris, and is 5 inches long, with a greatest width of base of $1\frac{1}{4}$ inches, and on this pipe again are seen the file marks at one point, under the flaring top of the bowl, though they are not so pronounced as they are on many other specimens.

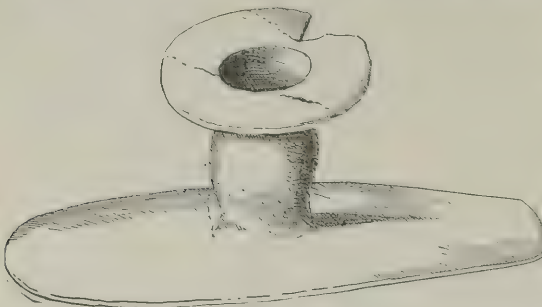

Fig. 94.
BROAD-BASED MONITOR PIPE.
Knox County, Tennessee.
Cat. No. 135089, U.S.N.M. Collected by J. W. Emmert.

A pipe having a stem peculiarly of this type, as well as a bowl of the monitor shape, is fig. 96, from Loudon County, Tennessee. It has no flat prow extending in front of the bowl, but there is at its base, on the side toward the smoker, a triangular depression, cut in intaglio and polished, that is convincing that the specimen was made by a person familiar with a metal pipe of similar shape, and if anything were necessary to strengthen this belief it is presented in the gracefully curved upper rim of the bowl. The file marks on this specimen again leave no doubt of European contact with the persons who used them. There is yet another pipe in the U. S. National Museum collection (Cat. No. 135081) from Knox County, Kentucky, of similar type to the last figure, but upon which the depression is absent, as are the file marks, though the material of both pipes is the same.

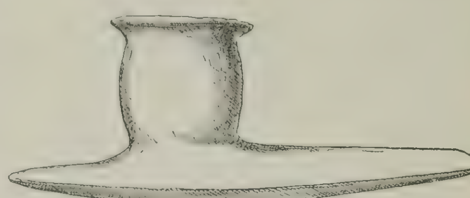

Fig. 95.
CURVED-BASE MONITOR PIPE.
Kanawha County, West Virginia.
Cat. No. 90840, U.S.N.M. Collected by J. W. Norris.

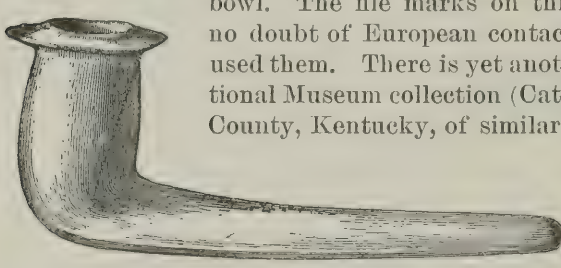

Fig. 96.
CURVED-BASE MONITOR PIPE.
Loudon County, Tennessee.
Cat. No. 116048, U.S.N.M. Collected by J. W. Emmert.

A pottery pipe of clay mixed with mica. Belonging apparently to this type is fig. 97, collected by Dr. J. D. Irwin, United States Army, at Fort Wayne, Wayne County, Michigan. It is scarcely $2\frac{1}{2}$ inches long, has many of the characteristics of the "monitor," especially in its stem

with flat base and in the projection in front of the bowl. Just below the rim is a depression encircling the bowl as though caused by a cord tied around it while in a plastic condition prior to burning.

A light gray serpentine pipe (fig. 98), collected from Ross County, Ohio, by Mr. H. L. Reynolds, is somewhat of the same type as the preceding, though there is a notable difference in the size of the stem hole, which is here five-eighths of an inch in diameter in place of one-eighth of an inch, as is usual in pipes of the monitor type. It should be stated that in referring to the material from which pipes are made the writer has in most cases been obliged to form his opinion from surface indications, as specimens would be injured by a chemical or microscopic examination, the results of which at best could make little difference. While the majority of pipes are made of materials well calculated to resist heat, many are composed of stones easily decomposed and very unsuited to last any length of time if used in smoking.

Fig. 97.

POTTERY MONITOR PIPE.

Fort Wayne, Michigan.

Cat. No. 10050, U.S.N.M. Collected by J. D. Irwin, U. S. A.

Fig. 98.

TYPE OF MONITOR PIPE.

Ross County, Ohio.

Cat. No. 134723, U.S.N.M. Collected by H. L. Reynolds.

A broken-stemmed pipe (fig. 99), of oolitic limestone, with its flaring rim, the shape of its stem and slight prow and sides extending beyond the base of the bowl, appears to connect the two last figures with pipes of the "monitor" type. There are no marks of metal tools on this pipe, which is a well-worn specimen, the bowl at one point, just below the rim, being worn through. A pottery pipe similar to this specimen was found in a stone grave in Kentucky. It should be observed that the three pipes last figured are from geographical areas outside of the territory where the monitor pipes are usually found, and their resemblance to the latter form may be due to accident. The country adjoining the lakes was more influenced by French than by English arts, and it may also be said that trade routes differed as well.

One of the most striking things concerning the monitor pipes, with their alate wings and projecting prow, is the high state of polish to

which their surfaces have been brought. There are a sufficient number of pipes of this class in the museums of the country to demonstrate the kinship of those in which the bowl and stem are in the same plane with those in which the bowl is at right angles to the stem.

These pipes are represented in the U. S. National Museum in specimens from Vermont, New Hampshire, Massachusetts, Rhode Island, North and South Carolina, Tennessee, Kentucky, West Virginia, and, as noted, possibly from Michigan, Ohio, and Wisconsin. Their characteristics are usually as pronounced as are those of the English trade pipe type. As the angle of the stem and bowl of this pipe, in its evolution or variation, departs from the straight line or tubular form and approaches a right angle to the stem it is noted that the prow increases in length until it becomes as long as its stem, and the sides of the bowl's base broaden to a corresponding degree. They are so often found in mound burials as to entitle them to be classed among the mound types; and, indeed, the typical mound pipe has much in its form to suggest a kinship with the monitor pipe.

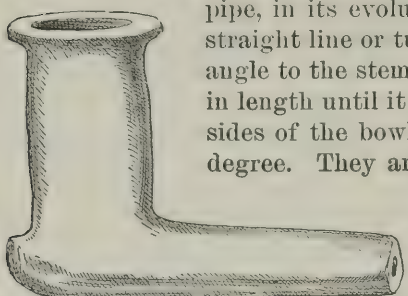

Fig. 99.

TYPE OF MONITOR PIPE.

Kanawha, West Virginia.

Cat. No. 9068, U.S.N.M. Collected by P. W. Norris.

There is a pronounced monitor pipe in the Peabody Academy of Sciences in Salem, Massachusetts, catalogued as from Maryland—a State that is distinctly within the area of the monitor form—a more particular history of which could not be obtained.

Prof. F. W. Putnam refers to a pipe of this type found in a grave in Massachusetts, and says the flat portion of the specimen is bored with a number of holes for the attachment of ornaments.[1]

The same type, according to Mr. Harry Piers, has been found in Halifax County, Nova Scotia.[2]

Prof. G. H. Perkins refers to it in the Champlain Valley, Vermont.[3]

The Peabody Academy of Sciences owns several found in Beverly, Massachusetts, and they have been found in New York, in Oneida, Onondaga, and Cayuga counties.[4]

RECTANGULAR PIPES.

There is a pipe of a distinct type, examples of which are found from Pennsylvania to Nova Scotia and as far west as Ohio, which by many are supposed to be specimens of aboriginal work, though to the writer they appear to be made with white men's implements. Those which

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[1] Bulletin of the Essex Institute, III, p. 123.

[2] Transactions of the Nova Scotian Institute of Natural Science, VII, p. 286.

[3] Popular Science Monthly, December, 1893, p. 243.

[4] Rev. W. M. Beauchamp and Mr. John Robinson, in private letters.

have come under observation are made from a dark green steatite or chlorite, a stone quite common along the Atlantic coast north of the Chesapeake. These pipes have bowls and stems at right angles to each other, and have invariably a beast or bird the head of which projects above the bowl on the side away from but facing the smoker.

Gen. A. L. Pridemore has a specimen found in Lee County, Virginia.

Quite a large pipe in an unfinished condition is from Bradford County, Pennsylvania, collected by Messrs. O. H. P. Kinney and J. B. Wiggins. It appears to have been sawed out with metal tools. It is 10 inches long, 4½ inches high, with a diameter of bowl of 1½ inches. As seen in fig. 100, it is completely blocked out and is in a condition to indicate that it was intended to be completed, representing some creature grasping the bowl with all four legs, the head projecting 1½ inches above the adjacent rim of the bowl. On the sides depressions have been gouged out with a tool with a round back, single strokes measuring over 1 inch in length, the smoothness of which indicates that it was a metal gouge. The bowl and stem holes, bored by means of metal drill points, are respectively five-eighths and five-sixteenths of an inch in diameter. The stem is broken at a depth of 1½ inches where the drill has encountered a flaw, which accounts for its having been cast aside. We see here much of the process of manufacture of the elaborate stone pipe, the specimen first being rudely outlined; next the bowl and stem were bored, then the elaboration of carving was completed, leaving the polishing to the last.

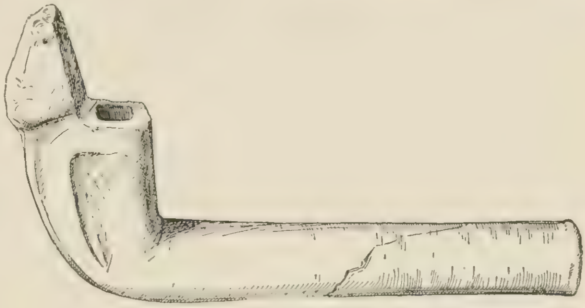

Fig. 100.

RECTANGULAR PIPE.

Bradford County, Pennsylvania.

Cat. No. 58851, U.S.N.M. Collected by O. H. P. Kinney and J. B. Wiggins.

Fig. 101.

RECTANGULAR PIPE.

Lancaster County, Pennsylvania.

Cat. No. 27037, U.S.N.M. Collected by T. H. Bean.

In fig. 101, found in Lancaster County, Pennsylvania, by Dr. T. H. Bean, like fig. 100, is a pipe of steatite 8½ inches long and 3 inches

high. The bowl of this pipe is 1¼ inches in exterior diameter. Though the stem is 7 inches long to its point of junction with the bowl, it does not exceed three eighths of an inch in its greatest diameter. The creature on the bowl appears to be intended to represent a bird, though, whatever it be, it is inclined to the left and has incised lines on the back as though intended to represent wings. On the breast there are marks in one place, apparently made by a file, and on the bowl similar marks are seen. The individual making the pipe has failed to obliterate the tool marks in smoothing the surface, which in this instance has an unusually good polish. Without the figure the pipe is in outline similar to the briarwood pipes of the present day. The material is steatite such as has been worked by the natives along the whole Atlantic coast. This pipe was found near Bainbridge during the excavation of the Pennsylvania Canal. A similar pipe, but an inch shorter, belonging to the Hon. W. J. Almon, of Halifax, is spoken of by Mr. Harry Piers as being the most remarkable one found in the Provinces. It was discovered in 1870 under an upturned copper kettle within 10 rods of an old French trail in Hants County, Ontario. It is said to have a well-carved lizard grasping the bowl, while "across the back of the neck appears a row of five elliptical cavities, their greatest length being in the direction of the body."[1]

The material of which these pipes in the north are made is described as a fine-grained stone, probably a steatite, the elliptical depressions on which call to mind cavities noticeable among the stone and clay pipes of the St. Lawrence River and northwestern New York, such as are supposed to have been employed by the Iroquoian tribes.

There is a cast in the U. S. National Museum collection of a pipe of this type (Cat. No. 13804), having the same long stem, which is said to have been found in a mound in Warren County, Ohio, collected by Mr. J. H. Jenkins, and upon which an animal faces the smoker from the far side of the bowl, as in those pipes of similar type herein figured.

The Rev. William M. Beauchamp calls the writer's attention to a clay pipe of this general type, though much smaller, which was found in Jefferson County, New York, upon the bowl of which there was represented a crayfish with one claw broken off, though such a pipe would appear to belong rather to the Iroquoian type. Mr. Beauchamp also states that turtles are often represented in the same way, as are many animals and birds on pipes of the Iroquoian type.

Mr. David Boyle illustrates a pipe of white stone, which was found on Baptiste Lake, Hastings County, Ontario, upon the outer side of which the animal holds the bowl in the grasp of its four legs, while its tail reaches down the bowl and under it and along the stem[2] in the direction of its longest axis.

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[1] Relics of the stone age in Nova Scotia. Transactions of the Nova Scotian Institute of Natural Science, IX, p. 54.

[2] Notes on Primitive Man in Ontario, p. 52, fig. 121, Toronto, 1895.

The stone from which the French Canadians early made pipes is, according to Peter Kalm, the Swedish traveler and botanist, a limestone found in strata between the lime slate of the country, and which he calls pierre à calumet. These rectangular pipes, having birds or other creatures in relief on their bowls, were made, in all probability, either with tools obtained from the whites, or by the whites themselves. The gouge marks in the bowl, the sharp striæ of the drill, the high polish, and file marks, all go to confirm this belief, while the finding of one of them under a copper kettle identifies pipe and kettle as contemporaneous. These, together with the artistic treatment of the subject, seems to indicate a stage of development above and beyond primitive conditions. This suggestion will probably be combated, though a careful comparison of American Indian pipes carved in imitation of different members of the animal kingdom, are so little like those fetiches which are known to be of purely Indian origin, the tool marks of knife or file are so distinct, and the treatment of the subject so clearly European, as to leave but little doubt of their modern origin.

There is evidence of the existence at an early colonial period of metal pipes, both of copper and of iron, but few have survived owing to the corrosive effects and the dampness of our soil. Those of iron were of European origin, while copper pipes were possibly of pre-European date. Judging from allusions by early writers, the Indians in places also made pipes of wood and of bone, though none appear to have been discovered, excepting those tubes of cane which were buried in certain places in New Mexico.

Atwater says: "Pipe bowls made of copper, hammered out and not welded together but lapped over, have been found in many tumuli. General Tupper described such an one to me, found by him on the elevated square at Marietta, or rather a few feet below that work, and similar ones have been discovered in other places."[1]

Haywood reiterates a similar remark in reference to the finding of hammered copper unwelded pipe bowls in the mounds of Tennessee,[2] and calls attention to the finding of objects of gold, silver, and copper and of coins in the mounds.

Hendrick Hudson, in 1609, speaks of the people of New York on the east sand bank in the Narrows who "came aboard us and brought tobacco. They have great pipes of yellow copper, and pots of earth to dress their meats in."[3]

The memory of such pipes had survived to the end of the last century, for Kalm, speaking of the same locality, says, "However, they [the Indians] knew in some measure how to make use of copper.

[1] Caleb Atwater, Description of the Antiquities of Ohio, Archæologia Americana, I, p. 224.

[2] John Haywood, Natural and Aboriginal History of Tennessee, p. 343, Nashville, 1823.

[3] Robert Jouet, Third Voyage of Master Henry Hudson, p. 81 (Hakluyt Society).

Some Dutchmen who lived here still preserved the old account among them that their ancestors on their first settling in New York had met with many Indians who had tobacco pipes of copper, and who made them understand by signs that they got them in the neighborhood. Afterwards the fine copper mine was found upon the second river between Elizabethtown and New York."[1]

In a monograph of the archæology of Ohio, Mr. M. C. Read speaks of hammered copper pipes as being very uncommon, he having seen only one specimen.[2] Squier and Davis express their belief that the North American Indians possessed the knowledge of some secret or forgotten process by which copper was hardened.[3] This is an assertion which has often been advanced by archæologists, referring to metal used both in South America and in Egypt, but for which assertion there appears no foundation other than that, as these peoples carved hard stone, and had no iron, therefore they must have known how to harden copper. Since, however, it has been demonstrated that the stone hammer, common to all parts of the earth, could cut the most obdurate stones with ease and dispatch, such assertions must be received with great caution.

Dr. E. A. Barber refers to a copper pipe found in Montour County, Pennsylvania, concerning which he expresses doubt as to whether it be aboriginal, and suggests that it may have been traded to the Indians by Europeans,[4] though if the natives hammered copper there is no reason why they should not have formed it into tubes. Another tobacco pipe, made of lead, was found in an Indian grave at Revere, Massachusetts.[5]

The writer has seen a tomahawk pipe made of tin or lead, now in the museum of the University of Pennsylvania, which was probably of the date of the American Revolution, if not later.

A large number of stone pipes in the U. S. National Museum collection, which were found in North and South Carolina and Georgia, are made of a dark green chlorite, which is of a color suggestive of copper. These pipes have usually embossed disks upon their bowls, and tongues reaching from stem to bowl, carved in a manner to leave little doubt that they had metal prototypes.

Metal pipes are recorded of so many various types and have been found in so many different localities as to suggest their common use at a very early period. Most of these pipes, however, are either cast or brazed, or are of a form which is quite modern, though one specimen made of lapped sheet metal is probably of aboriginal workmanship, though possibly of a post-European date. Although the writer is of opinion that metal pipes do not antedate European occupation of the

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[1] Peter Kalm, Travels into North America, I, p. 384, Warrington, 1771.

[2] Archæology of Ohio, p. 51, Cleveland.

[3] Ancient Monuments of the Mississippi Valley, p. 196.

[4] Antiquity of the Tobacco Pipe in Europe, American Antiquarian, II, p. 5.

[5] Annual Report of the Peabody Museum, II, p. 483.

country, it must be admitted that the evidence relating to their age is of so fragmentary a character as not to warrant the positive expression of an opinion on the subject.

De Soto as early as 1539 with a large body of men crossed an extensive section of the southern portion of what is now the United States. His people were familiar with the working and fusing of metals, and several of his soldiers wandered off and were never heard from again, and he is supposed to have penetrated far toward the borders of Kentucky.[1] Fifty years later the English landed in Virginia, and from that period for one hundred and fifty years Spanish, French, English, Dutch, and Swedes traded along the coast and far into the interior with the natives for their peltries, and their intercourse was of a character to familiarize them with the white man's implements and his use of metal.

Mr. Clarence B. Moore found at Fairview, Camden County, Georgia, a foot below the surface in a mound, a deposit of calcined human bones beneath a local layer of oyster shells, and associated with the bones was a sheet-copper ornament with repoussé decorations.[2] He refers also to four rings found on the finger of a skeleton at Madisonville, Ohio, by Professor Putnam, which were made from bands of sheet copper. Besides finding a copper finger ring in a mound near Woodbine, Georgia, and also a portion of a disk of copper in a mound in McIntosh County, Georgia, which was carbonated through, Mr. Moore also found an 8-inch copper celt in a mound north of Creighton Island, Georgia.[3]

Such objects are said to be usually found near the surface, and polychrome and other glass beads were found in the mounds at a depth of 2 feet with human remains or near the surface.[4]

Glass beads, pieces of china, copper coins, gold ornaments, and silver crosses have been found on so many occasions in the graves and mounds of the interior associated with human remains as to suggest that the trade with the whites was considerable at a period when mounds were still being constructed and while the Indian was yet living under primitive conditions.

MICMAC PIPES.

As far south as the borders of Kentucky and extending as far as the Blackfeet wander, in Labrador and across the continent almost if not quite to the Pacific Ocean, there is found a type of pipe which appears quite primitive in form, yet which is still in use in the northern part of the continent. It has a bowl, in shape not unlike an inverted acorn, which sits upon a keel-like base, broadest where it touches the bowl, and extending beyond the bowl at times an inch or more on each side.

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[1] Bennett H. Young, The News, Louisville, Kentucky, April 2, 1896.

[2] Certain Aboriginal Mounds of the Georgia Coast, Journal of the Academy of Natural Sciences of Philadelphia, XI, p. 10, 1897.

[3] Idem, pp. 13, 14, 25, 41, Philadelphia, 1897.

[4] Idem, pp. 14, 23, 66, Philadelphia, 1897.

Through the top of this base or keel there is drilled a stem hole one-half its length until it intersects at right angles the base of the bowl. The tops of these terraced bases are seldom more than half an inch wide, though from front to back they are often 3 inches or more long, and from top to bottom they are as deep as long. The sides of the bases are parallel to each other, and are in two or three terraces, decreasing often until the lower part of the base is scarcely more than one-eighth of an inch thick. Through this base there are almost invariably one or more perforations.

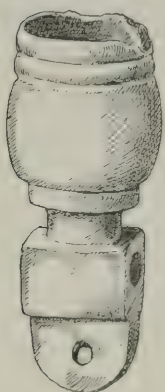

Fig. 102.
MICMAC PIPE.
Newark, Ohio.
Cat. No. 17314, U.S.N.M.
Collected by W. Anderson.

That the northern tribes have long been familiar with carving must be admitted, for Lescarbot says of the Micmacs[1] they "have the industry both of painting and carving, and do make pictures of birds, beasts, and of men, as well in stone as in wood, as prettily as is done by good workmen in these parts; and notwithstanding they serve not themselves with them in adoration, but only to please the sight, they use some private tools, as in making tobacco pipes."[2]

Prof. Daniel Wilson refers to Pabamesad, or the Flier, still living on the Great Manitoulin Island, generally known as Pwahguneka, the pipe maker, literally, "he makes pipes." "His saw, with which the stone is first roughly blocked out, is made of a bit of hoop iron, and his other tools are correspondingly rude; nevertheless the work of Pabamesad shows him to be a master of his art."[3]

Professor Wilson refers to the black pipestone of Lake Huron, the white pipestone from St. Josephs Island, Lake Huron, and the red pipestone of Coteau des Prairies, all obtained from the different tribes using these stones.

Gilpin says the Micmacs used "shallow stone pans with quills and reeds stuck in them, but did not cultivate tobacco."[4]

The only shallow stone pan apparently answering such description would be the disk or jew's-harp pipe usually found to the southward, though examples have been encountered on the northern side of Lake Huron.

Fig. 102 is a fine-grained, brown, argillaceous stone pipe, about 2 inches high, with a greatest diameter of three-fourths of an inch, from Newark, Ohio, collected by Mr. W. Anderson. It is ground over its whole surface; the bowl has an interior uniform diameter of five-eighths

[1] Souriquois, who were the Micmacs of New Brunswick, not of Nova Scotia, and Amorichiquois, literally the people of small dogs, an Algonquin people of New England south of the Alemaki.

[2] Relics of the Stone Age in Nova Scotia, quoting Lescarbot, Transactions of the Nova Scotian Institute of Natural Science, 1894 and 1895, IX, p. 57, note.

[3] Prehistoric Man, I, p. 392, London, 1876.

[4] Transactions of the Nova Scotian Institute of Natural Science, III, p. 222.

of an inch, carried to a depth of seven-eighths of an inch, and in this respect resembles the mound pipes. At the base of the bowl a one-eighth inch hole perforates the stem opening, which enters through the longer axis of the base. The keel-like bases of these pipes are almost invariably bored from side to side with holes from one-sixteenth to one-eighth of an inch in diameter, for the purpose of attaching strings to prevent loss in the snow, leaves, or grass, it being noticeable that the pipes of those places where deep snows commonly lie are more apt to be of a shape indicating a string attachment for the stem than are those found in warmer latitudes. A specimen similar to this pipe (Cat. No. 115452, U. S. N. M.), from a mound at Prairie du Chien, Wisconsin, collected by Mr. J. W. Emmert, is composed of an almost white limestone, possibly the white pipestone of Lake Huron. It has a bowl in the shape of an elongated cone, gradually lessening toward its base, the whole pipe being 3 inches high, and has the lateral perforation so commonly observed.

Fig. 103.
MICMAC PIPE.
Ungava, Labrador.
Cat. No. 1119, U.S.N.M.
Collected by Lucien M. Turner.

The Rev. W. M. Beauchamp refers to another pipe of this type which he attributes to Seneca ownership and thinks the type recent. A similar pipe was found near Waterloo, Dekalb County, Indiana.

Fig. 103 is a modern pipe, having a stem of spruce wood, from Ungava, Labrador, collected by Mr. Lucien M. Turner, and is of a blood-red banded slate, with yellow veins running through it. It is 3½ inches high, the bowl decreasing in diameter to half an inch at the point where it joins the keel-like base, the stem being attached to the pipe by a fine sinew yarn. There are three lines, two at the bottom and one near the rim, and incised on the bowl; on the base file marks are distinct. Mr. Turner says of these pipes: "They vary but little in shape and are liable to crack if used in cold weather, and there is considerable difference in size. The largest ones are made of green stones. The rough stone for the pipe is selected and chipped into form. The successive operations of wearing it down are accomplished by means of a coarse file or harder stone."[1]

It is surprising to find evidences of the use of the file on the surfaces of so many pipes of stone which are considered to belong to the most primitive periods. The pipe of the Déné who live between 50° and 52° 30′ north latitude and between the Fraser River and the Cascade range of mountains, is identical in type with these pipes. Father Morice remarks: "A fact which will perhaps elicit incredulous comment is that not only our aborigines' earliest acquaintance with tobacco, native or nicotian, dates only from 1792 for the Tsé Kehné, and 1793

[1] The Hudson Bay Eskimo, Eleventh Annual Report of the Bureau of Ethnology, p. 304.

for the Carriers, but even the very act of smoking was unknown to them prior to those dates. As a consequence, pipes of any material or form are an adventitious item amongst them. Bowl and stem are connected by a chain of dentalium shells alternating with colored glass beads. A pipe similar in form, but without the string of beads and shells, was also in use among the Shushwap Indians, the southern neighbors of the western Dénés, as appears from a sketch in Dawson's notes on the Shushwap Indians proper of British Columbia."[1]

This author asserts that "both the Tsé Kehné and the Carriers are positive tobacco was unknown to their ancestors previous to their encounter with Sir Alexander McKenzie."[2]

A pipe of this character from the Shushwap people of British Columbia, between the Fraser River and Thompson River, is described by Dr. George M. Dawson.[3]

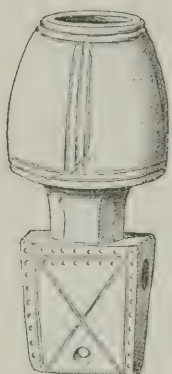

Fig. 104.

ORNAMENTED MICMAC PIPE.

Fort Niagara, New York.

Cat. No. 6196, U.S.N.M. Collected by E. Jewett.

An ornamented pipe (fig. 104) of this type from Fort Niagara, New York, collected by Col. E. Jewett, is 3 inches high, the bowl having an exterior greatest diameter of $1\frac{3}{4}$ inches. The base is wedge shaped, between which and the bowl there is a narrow neck or shoulder cut in octagon. The stone is a black slate, probably the black pipestone of Lake Huron, to which Professor Wilson referred. The bowl is ornamented with perpendicular and circular parallel lines in panels, the base having small depressions around three of its sides and two straight lines crossing each other which have been incised with a steel tool apparently. A pipe through the base of which are two holes, one above the other, is referred to by Piers, "the bowl and keel of which are most tastefully ornamented with single and double straight lines, dots, very short diagonal dashes, and conventional branches of foliage, all arranged in neat design, which entitle the carver to much credit for his excellent work."[4]

The same author refers to another specimen of the Micmac pipe, "the base of which is cut into three lobes, each of which has a small perforation through it, probably for the purpose of attaching some ornament." This pipe was found near the river Dennis, Cape Breton. Yet another, though more finely finished, was found at Dartmouth in 1870, with only one hole through the keel, and a similar one made of red

[1] Father A. G. Morice, Notes on Western Dénés, Transactions of the Canadian Institute, session 1892–93, p. 36.

[2] Idem, p. 36.

[3] George M. Dawson, Notes on the Shushwap People of British Columbia, Transactions Royal Society of Canada, 1891, p. 12.

[4] Harry Piers, Relics of the Stone Age in Nova Scotia, Transactions Nova Scotian Institute of Natural Science, 1894–95, IX, p. 57.

clay was found at Halifax which was considered to be of European manufacture, on one side of the base of which is scratched 1560, to which, Mr. Piers thinks, no importance can be attached.[1]

Prof. John Robinson, of the Peabody Academy of Science, Salem, Massachusetts, refers the writer to yet another specimen of this class, from Mickelfield, Pictou County, Nova Scotia, having an ornamented keel-like base, perforated with five holes. The pipe is made of talcose slate, nearly black in color, and was found 5 feet below the surface in digging a well. The locality where this pipe was found has been settled for one hundred and fifty years. Professor Robinson thinks the pipe was certainly made with a knife and other steel tools, and as it is fresh, clean cut, he supposes it either to have been made by a white man and given to the Indians, or, if made by the Indians, that it was done with a white man's tools.

Another pipe of this type, from Grosse Pointe, Lake St. Clair, Michigan, is referred to in the Smithsonian Report of 1873 as "an object worthy of some admiration, though wanting in symmetry in its details. In its general appearance it is almost elegant, and even graceful. It is formed of greenstone and is beautifully polished, the workmanship, as a whole, displaying much skill. This singular relic is in perfect preservation, with the exception of part of the base of the bowl, which in shape resembles a half-closed tulip, a small portion is also wanting. The date 1697, inscribed on one side of the base, is of interest. The antiquity of the pipe is, in my estimation, much greater than this would imply. The date of the settlement of Detroit is 1701, but the Jesuits and other white men had already penetrated to this region many years before."[2]

Hind refers to a pipe of this type which Mis tick oos, a Cree, when relating his adventures, raised the pipe he held in his hand and exclaimed: "This is what my Blackfoot friend gave me one day; the next he killed my young men; he is now my enemy again."[3]

Holm's remark, referring to New Sweden, "that the Indians leaned upon their pipes," would be received with incredulity were it not that Hind represents "the Fox," a Plains Cree Indian, holding in his hand a pipe upon which he leans as one would upon a staff.[4]

The office of custodian of the great pipe is an important one among the Blackfeet, according to Warren, who asserts that a person "is appointed every four years by the elders and chiefs to take charge of the sacred pipe, pipestem, mat, and other emblems of their religious beliefs. A lodge is allotted for his especial use to contain these emblems

[1]Transactions of the Nova Scotian Institute of Natural Science, 1886-1890, p. 286.

[2]Henry Gillman, The Mound-Builders and Platycnemism in Michigan, Smithsonian Report, 1873, p. 370.

[3]Henry Youle Hind, A Narrative of the Canadian Red River Exploring Expedition of 1857, p. 126, London, 1860.

[4]Idem, II, pp. 126–127, plate V.

and articles pertaining to his office."[1] The Blackfoot pipes "are often ball or pear shape, a foot in length. The stem is of wood, broad, flat, or round—at times like a snake. The handsomest are the great medicine pipes. The tobacco they smoke consists of the little round dry leaves of the bearberry (*arctostaphylos uva-ursi*), called by them Kocksinn."[2] Hind illustrates several of these pipes, selected from his own collection, that are from the Cree, Blackfeet, and Chipewayan tribes.[3] Schoolcraft also illustrates the same pipe as Chipewayan.[4]

There is in the collection of the U. S. National Museum a cast of a pipe of this type said to be from Putnam County, Ohio (Cat. No. 58169), which represents in its bowl the head of an individual, apparently a European, which is probably of quite a recent period.

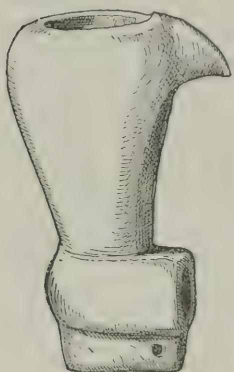

Fig. 105.

BIRD'S HEAD MICMAC PIPE.

Oriskany, New York.

Cat. No. 6819, U.S.N.M. Collected by E. Jewett.

A pipe from Oriskany, New York, collected by Col. E. Jewett, $2\frac{3}{4}$ inches high, made from a gray steatite, appears to be rather a crude effort to represent the head and beak of a bird, and is shown in fig. 105. The bowl and stem are without ornament, excepting five small dots in a row, one above the other, extending along a facet between the bird's beak and the top of the stem. A hole in the base for the string is scarcely more than one-sixteenth of an inch in diameter, the cavity of the bowl being seven-eighths of an inch in diameter, the sides of the interior of the bowl being parallel, a common but not invariable feature in pipes of this type.

By far the most ornate specimen of a pipe of this type yet described is one (fig. 106) in the collection of Mr. E. A. Douglass, which is $3\frac{1}{2}$ inches high and $1\frac{1}{2}$ inches wide and made from a close-grained dark brown stone. On its base are circles and lines in ornamental order which would answer the description of the Micmac pipe described by Mr. Piers; but there is a further ornamentation which adds greatly to its interest. Surrounding the bowl are four animals, carved practically in the round, which are apparently intended to have a totemic significance. Standing on the narrow keel base, with his back to the stem, is a bear, his two hind feet on the stem, while with his fore paws he appears to be reaching up as though endeavoring to get into the bowl; the end of his muzzle is even with the upper edge. Facing the bear, on the other end of the bowl, with its tail touching the stem, also erect and clasping the bowl with all four legs, is another animal, apparently

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[1] William W. Warren, Minnesota Historical Collections, V, p. 68.

[2] Maximilian von Weid, Reise in das innere Nord Amerika I, p. 570, plate XLVIII, Coblenz, 1839.

[3] A Narrative of the Canadian Red River Exploring Expedition of 1857, II, p. 140.

[4] North American Indian Tribes, Pt. 2, plate 70, fig. 7.

an otter. On the bear's right, also climbing the bowl, is a beaver at full length, while opposite the beaver is a terrapin, or turtle, also clasping the bowl and trying to climb to the top. The beaver's head is even with that of the bear, as were presumably the heads of the otter and terrapin, which, unfortunately, have been broken off at the neck. The shell of the turtle, the scales of his legs, and his claws, and the hair and limbs of the other animals are carved with the minutest regard to detail. The etching of semicircles, circles, conventional branches of plants, dots, straight and curved lines, all bear evidence of foreign influences and metal tools, every detail being executed with such skill and taste as to leave no doubt of its being the work of an artist. Such care in the manufacture of a stone pipe is proof of its being intended for a person of importance, or a present on some occasion of unusual significance between the French or English and the Indians. The animals here represented are all totems of the Iroquois, and are said also to be those of all the tribes from Louisiana to Montreal.[1]

Fig. 106.

TOTEMIC MICMAC PIPE.

St. John River, Maine.

Collection of Andrew E. Douglass, New York City.

This pipe is said to have been found on the bank of the St. John River, in northeastern Maine. There are in the Bragge collection pipes apparently of this type from the area where these are referred to as being found: One, from Canada, having upon it two beavers and two smaller animals; one, from below Quebec, with two dogs and two bears upon it; one, from an island below Quebec, having on it an eagle, monkey, bear, cat, and a dog; another, two bears, a fox, and a bird, all apparently of this Micmac type.

A graceful little pipe of catlinite (fig. 107) collected by Mr. J. Peters, from Kentucky, $1\frac{3}{4}$ inches high, upon the stem of which the figures 1717 are rudely incised, is quite an artistic affair. Whether these figures indicate an actual date, however, is a matter impossible to determine. The bowl is badly broken, though the base is whole and consists of a crouching animal, and has a single hole for the string.

[1] Lewis H. Morgan, League of the Iroquois, p. 79, Rochester, 1851.

The specimen being highly polished would indicate a probable modern origin. The bowl and stem both have thin walls and the unusually large aperture of the stem is the only departure observable from type characteristics.

This type, it will be observed, extends practically from the Atlantic to the Pacific, through the territories of Athabascan, Iroquoian, and Algonquin linguistic stocks, and so commonly shows file marks and high polish as to suggest the white man's presence, for it is scarcely necessary to say the file could not be acquired from native sources, and high polish of implements is almost unknown through the center of the American continent among tools of purely aboriginal make until the Indians possessed a supply of the white man's implements. This type is undoubtedly an old one, and some of the specimens bear evidence of being made with primitive tools, though the territory through which they are distributed is that of the Hudson Bay Fur Trading Company, and very likely is of a type sold by them to the Indians. The dates on these pipes add interest to them beyond a mere record of their possession by the whites at a given period. The file mark may be the only evidence of its having supplanted the gritty stone in the Indian's hand, and the polish only indicative of a natural advance over the primitive ground surface.

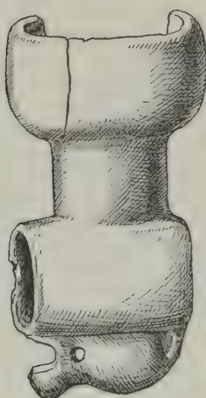

Fig. 107.

CATLINITE PIPE.

Kentucky.

Cat. No. 16690, U.S.N.M. Collected by J. Peters.

Mr. Beauchamp has called the writer's attention to a peculiar pipe, made from black steatite, found in Onondaga County, New York, the bowl of which is shaped like a man's head, the eyes "inlaid with hollow bone," the type of face being European. The stem hole is at right angles to the bowl, but is smaller than is the case with the Micmac pipe; a projection below the bowl may be intended as a handle to hold it by when hot. A somewhat similar outline is noted in a pipe made of steatite, and found in 1844,[1] illustrated by Schoolcraft, said to be from the Grave Creek Mound in Virginia.

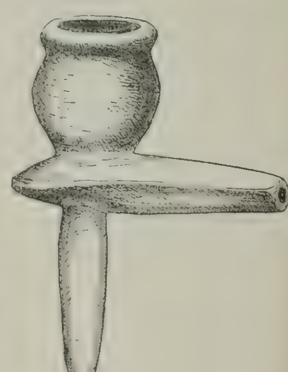

Fig. 108.

PIPE WITH HANDLE.

Loudon County, Tennessee.

Cat. No. 116057, U.S.N.M. Collected by J. W. Emmert.

A fair specimen of these pipes is one (fig. 108) from a mound in Loudon County, Tennessee, collected by Mr. J. W. Emmert, which has this projecting base extending below the bowl, the stone being a greenish serpentine or steatite, on the surface of which the file marks

[1] North American Indian Tribes, Pt. 1, p. 75, plate 8, fig. 4.

are quite distinct. The specimen is $2\frac{1}{2}$ inches high and 2 inches long, the shape of the bowl opening being of a distinctly elliptical form, similar to certain of the typical mound pipes. Another pipe of this character was found at Newark, Ohio, on the bowl of which there was an animal head.

A specimen of the same type in the collection of the Davenport Academy of Natural Sciences was found in Jo Daviess County, Illinois, and is made of pipestone of slightly greenish tinge.

DISK PIPES.

There is a pipe of most peculiar shape, known commonly as the "disk pipe," so called from the discoidal stem, which at first glance one would be apt to take for its bowl. The larger cavity being in a line parallel to the face of the disk would suggest that the stem was intended to be inserted through the disk, around which a thong would be tied to hold it more firmly in position, the depth of the disk being insufficient to hold a stem unless it were bound in some way.

A longitudinal section of such pipes shows similarity in bowl and stem hole to pipes found in the State of Missouri, though the exteriors are very unlike. This similarity is pronounced in a pipe of oolitic limestone from Chattanooga, which is illustrated by Thruston.[1]

A badly weathered white limestone specimen (fig. 109) of this type is from a mound in Union County, Kentucky, collected by Mr. S. S. Lyon. It is $3\frac{1}{4}$ inches long, and only $1\frac{1}{2}$ inches from the face of the disk to the opposite side of the pipe, the disk being $1\frac{1}{2}$ inches in diameter, with a bowl cavity of five-eighths of an inch diameter, by one-half an inch for size of the stem opening. Thruston illustrates two specimens of this type made of catlinite, one coming from the Noel stone grave cemetery, near Nashville, Tennessee.[2] In the Douglass collection there are six catlinite pipes of this character from Boone, Saline, and Chariton counties, Missouri.

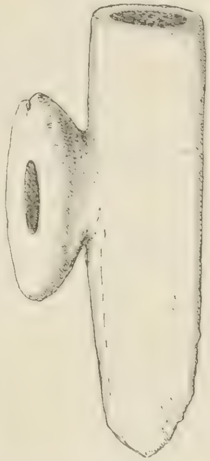

Fig. 109.
DISK PIPE OF LIMESTONE.
Union County, Kentucky.
Cat. No. 7677, U.S.N.M.
Collected by S. S. Lyon.

Mr. David Boyle, of Toronto, also describes two of these pipes, one from Middlesex County, and the other from Huron County, Ontario, one of which was made from catlinite. The bowls and stems are usually carefully drilled, and their exteriors are remarkably well polished. Dr. E. A. Barber describes pipes of this type from mounds in Missouri.[3]

[1] Gates P. Thruston, Antiquities of Tennessee, p. 201, 1890.
[2] Idem, p. 199.
[3] American Naturalist, XVII, p. 75, figs. 3, 4.

A specimen (fig. 110) of this type, part of the stem of which is missing, from Mount Carmel, Wabash County, Illinois, collected by Mr. J. Schenck, is made of light brown oolitic limestone. In its perfect state it was about 5 inches long, and is so carefully smoothed as to leave no visible marks of the tools by means of which it was made. Finding them of catlinite so far from the quarries would indicate that they are of no great age. Again, the shape is so suggestive of the jew's-harp, an instrument used extensively in trade with the Indians, as to indicate that the pipe itself is modeled after the form of this primitive musical instrument, even though the file marks, so common on many of the pipes, are absent from those coming under the writer's observation. A highly polished specimen was also found in a mound near Greenville, Bond County, Illinois.

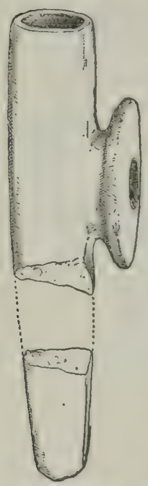

Fig. 110.
DISK PIPE OF OOLITIC LIMESTONE.
Wabash County, Illinois.
Cat. No. 17172, U.S.N.M. Collected by J. Schenck.

IROQUOIAN PIPES.

Throughout an extensive territory surrounding the Great Lakes is found a type of pipe distinct from those of other portions of the continent, which is so peculiarly distributed throughout the geographical area inhabited by the Northern Iroquoian groups as to justify calling the type "Iroquoian."

Powell's linguistic map shows that at the time of the first contact with the whites Iroquoian was the language spoken by the Indians on both sides of the upper St. Lawrence River, as well as by the tribes living around the shores of Lakes Ontario and Erie, covering the territory of a greater part of the State of New York and of northern and eastern Pennsylvania as well. These pipes are common throughout the greater portion of this area, but are not found in the territory of the Southern Iroquois, in West Virginia, North and South Carolina, eastern Tennessee, part of northern Alabama, and Georgia. The constancy of type in pipes through a given area is uniform, with but little variation, and as a consequence there should be found a similarity in the pipes of the Northern and Southern Iroquoian areas if they dated from a period prior to the separation of the race. Pipes of the Iroquoian type are made both of stone and pottery, the stone being usually a stalagma and the pottery commonly a hard-burned clay without shell tempering. These pipes are trumpet shaped quite often, though rectangular bowls are common. At times they have human heads molded on them, at others the figures are of birds or reptiles, all of which usually face the smoker, though there are numerous exceptions to this rule. The rims of the bowls are often of uniform height, but the edges of some of them are undulating owing to birds or beasts being molded on to the tops of the bowls. The stems of pottery pipes of this type are comparatively short, and their openings quite small, are equaled only by the

modern Zuni or Pueblo pipes. The stems of Iroquoian stone pipes are nearly at right angles to the bowls, whereas the curves in the pottery specimens are similar to those of the metal hunting horn of the European. Another peculiar characteristic of Iroquoian pipes is the form of the bowl, copied apparently from the hats of the soldiers of colonial days, with their high curved front, often affording space for the representation of standing or seated figures, which look as though copied from the sacred pictures or figures of the French churches. Another characteristic of the pipe of almost the whole of the Iroquoian area is observed in a series of ellipsoidal depressions upon the pipe bowl, the significance of which it is difficult to explain, though it is common on both stone and pottery examples. There is still another type of pipe that belongs to this region which has no stem, the form being that of a bird or animal always facing from the smoker.

The writer is inclined to attribute no great age to any of these ornamented Iroquoian pipes, at least none which would antedate French influences, though it is of course admitted that the smoking habit was noted upon the first arrival of the Europeans. So far as a knowledge of the artificial fracture of stones is concerned, or the haunts and habits of wild animals, or ability to follow the tracks of game, or, in fact, all outdoor knowledge incident to the forest or the prairie, the Indian was a past master; but the white man's arrival must have been as remarkable to the Indian as would be to-day a visit to earth from citizens of another planet, and the implements brought from Europe must have appeared marvelous.

It is related that during Cartier's second voyage to the St. Lawrence, in 1535, the captain commanded the trumpets and other musical instruments to sound for the purpose of surprising the natives, and there can be little doubt that the monotony of many a long voyage during the sixteenth and the seventeenth century was relieved by the sounds of music, of which all vessels carried a good supply. In the account of Sir Humphrey Gilbert's voyage in 1583 to the northern part of Newfoundland it is related "that for solace of our people and allurement of the savages we were provided of music in good variety, not omitting the least toys, as Morris dancers, hobbyhorse, and many like conceits to delight the savage people whom we intended to win by all fair means possible."[1]

Champlain, in 1603, relates that he "saw on an island 10 miles from Quinibequy [Quebec] *petun* [tobacco], which they also cultivated;" and he further says "they gave us quantities of *petun*, which they dry and then reduce to powder."[2]

The French appear to have adopted to a great extent the word *petun* for tobacco, a word, judging by early writers, derived from Brazil. Dawson says "the pipes of old Hochelega were mostly of clay, and of

[1] Sir Humphrey Gilbert, Hakluyt's Voyages, III, p. 189, London, 1810, reprint of 1600.

[2] Voyages de Champlain, pp. 95, 113, Paris, 1830.

many and sometimes elegant patterns; some were very plain and small, others of elegant cornucopia or trumpet form, and some ornamented with rude attempts to imitate the human face."[1] One somewhat elaborate example appears to have been found of the celebrated red pipestone or catlinite.

Had primitive pipes been of such a character, it is scarcely credible that Cartier would not have made some reference to so great a peculiarity. Lafitau, however, does refer to the pipe as a "cornet," owing clearly to its trumpet form, which was very pronounced among certain of these Iroquoian objects.

Prof. G. H. Perkins describes the pipes of the Champlain Valley region as "not so elaborate as those in Ohio, only two specimens having been found with faces on them. The stone used was steatite, gypsum, limestone, and slate; platform, bell shaped, trumpet shaped, and tubular pieces occur; the last named in common form, varying from 2 to 15 inches in length."[2]

Hochelega was on the site now occupied by Montreal, and Dawson informs us that the Iroquois, Hurons, and Crees had pipes of the same types with those of Hochelega.[1]

Lafitau (1724) tells us: "Every savage has always with him his petun sack, in which he carries his calumet, or pipe, tobacco, and the means of lighting a fire," but he also says, "they never march without carrying with them a long tube, through which they draw smoke almost to drunkenness; with it they shake up all the fibers of their brain, and become intoxicated, as if they had drunk wine to excess."[3]

He could certainly not have referred to any pipe of the Canadian country adjoining the lakes, for none had long stems, so far as we know, except the Micmac pipe. The Abbé Gallinée, in 1669, referring to the Falls of Niagara, speaks of the Outinaonatona (big-pipe people, Hewitt), Senecas.[4]

Dawson refers to tobacco being found in full force by Cartier, in 1535, and says it was probably cultivated at Stadacona and Hochelega. He says that he has seen tobacco growing on the Laurentian Hills, behind Murray Bay, on the lower St. Lawrence, in latitude 47° 40′, and that the Indians also used wild plants designated as petun and killikinik.[1] It should, however, be born in mind that little was known concerning tobacco as early as the first half of the sixteenth century, and the reference may well have pointed to sumac, red willow, bear berry, or even the squaw bush.

The Kionontatehronon, a people living a two days' journey from the Hurons, and speaking that language, are referred to as the Nation de

[1] J. W. Dawson, Fossil Men, p. 92, Montreal, 1880.

[2] International Congress of Anthropology, Chicago, 1889.

[3] Père Lafitau, Moeurs des Sauvages Ameriquains, II, p, 130, Paris, 1724, quoting Père du Creux Histoire de Canada, I, 76.

[4] Pierre Margry, Decouvertes et Etablisements des Francais, Relation de l'Abbé de Gallinée, Paris, 1875.

Petun as late as 1635.[1] These people, spoken of as Tionontates and Dionondades "were found in 1616, south of Lake Huron and just west of the Hurons. After the Hurons' defeat they were nearly destroyed in continuation of the same war."[2]

Kalm, in 1749, says of the Hurons, "before them hangs their tobacco bag, made of the skin of an animal, the hairy side turned outwards, and each of the Indians," he says, "has a tobacco pipe of gray limestone, which is blackened afterwards, and has a long tube of wood."[3]

These pipes do not appear to correspond in description to those now found in the Huron area of influence, though the tobacco bag was made much according to its owner's taste, and Kalm says that in Canada "every farmer plants a quantity of tobacco near his house in proportion to the size of his family. It is likewise very necessary that they should plant tobacco, because it is so universally smoked by the common people. Boys of 10 or 12 years of age run about with the pipe in their mouth as well as the old people. Persons above the vulgar do not refuse to smoke a pipe now and then. In the northern part of Canada they smoke tobacco by itself; but farther upward and about Montreal they take the inner bark of the red Cornelian cherry [*Cornus stolonifera*], crush it, and mix it with tobacco to make it weaker."[4]

In 1642 Fathers Raymbault and Jogues left the mission of St. Mary, and after seventeen days' navigation arrived at the Falls, where they met about 10,000 persons, and "learned of many other sedentary people who never knew European nations, among others the Nadouessis (Sioux), located northwest or west of the Falls. The first nine days they were traveling through another great lake, which begins above the Falls (Erie). The last nine days they travel through a river which runs into the land. These people cultivate corn and petun."[5]

The people referred to in 1667 as the Nadouessouek, "near the great river called the Messipi, are said to have lived in a prairie country abounding in all sorts of game. They have fields where they do not grow corn but only petun."[6]

Of the "Mohawks, Oneydoes, Onondagos, Cayugas, and Senekas," in 1724, according to Cadwallader Colden, it is said "that each of these nations is again divided into three tribes or families, who distinguish themselves by three different arms or ensigns, the Tortoise, the Bear, the Wolf."[7]

Robert Rogers adds to this list, in 1765, of distinguishing ensigns or coats of arms, the otter and the eagle.[8]

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[1] Relation des Jésuites en Canada, 1635, III, p. 33; 1636, p. 105; 1637, p. 163.

[2] American Antiquarian, I, p. 228; Historical Magazine, V, p. 267; New York Colonial Documents, IX, p. 1886.

[3] Travels into North America, III, p. 180, London, 1771.

[4] Peter Kalm, Idem, III, p. 254, London, 1771.

[5] Laudoniere, Relation de la Nouvelle France, p. 97, 1642.

[6] Relation des Jésuites en Canada, III, p. 23, 1667.

[7] Cadwallader Colden, The Five Nations of Canada, p. 1, London, 1724.

[8] Robert Rogers, A Concise Account of North America, p. 226, London, 1765.

Lewis H. Morgan specifies, in 1851, eight tribes in each nation, arranged in two divisions, and names them as follows: Wolf, bear, beaver, turtle, deer, snipe, heron, hawk. These clan names, he says, are common to all latitudes between Montreal and Louisiana.[1]

This arrangement leaves out the classes of the otter and the eagle, referred to by Rogers. The more thorough our knowledge becomes of the Indian the more numerous appear his clans, and for each clan there is its appropriate totem. These totems are constantly represented on the Indian's pipe, scratched into the stone or carved in relief, or at times even carved in the round.

One of the quaintest of references to tobacco, or plants used in the manner of tobacco, is that of Cartier, in 1635. He says:

"There groweth also a certain kind of herbe, whereof in summer they make great provision for all the yeere, making great account of it, and only men use of it, and first they cause it to be dried in the sunne, then weare it about their neckes wrapped in a little beasts skinne made like a little bagge, with a hollow peece of stone or wood like a pipe, then when they please they make pouder of it, and then put it in one of the ends of said Cornet or pipe, and laying a cole of fire upon it, at the other end sucke so long, that they fill their bodies full of smoke, till that it cometh out of their mouth and nostrils even as out of the Tonnel of a chimney."[2]

This reference to the cornet would indicate that the pipe had the shape of the musical instrument or trumpet, which form is very ancient, and is found among the oldest hammered bronze implements of Norway,[3] and probably the rest of Europe. The hunting horn is familiar to all and comes probably from a civilization antedating that of Europe. Rev. W. M. Beauchamp, of Baldwinsville, New York, one of the best authorities in the country on the Iroquoian pipe, says they rarely made stone pipes until they had metallic tools. Many nations, he says, made pipes to sell, as the Petuns of Canada, and the Narragansetts. They were offered to water spirits on Lake Champlain and elsewhere. The more recent Iroquoian pipes, he thinks, have the face usually turned from the smoker. The Iroquoian tomahawk pipes, according to Morgan, were "made of steel, brass, or iron. The choicer articles are surmounted by a pipe bowl, and have a perforated handle that they may answer the double purpose of ornament and use. In such the handle and often the blade itself are richly inlaid with silver. They use it in close combat with terrible effect, and also throw it with unerring certainty at distant objects, making it revolve in the air in its flight. With the Indian the tomahawk is the emblem of war itself. To bury it is peace, to raise it is the most deadly warfare."[4]

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[1] Lewis H. Morgan, League of the Iroquois, pp. 79, 80, Rochester, 1851.

[2] Jacques Cartier, Second Voyage, Hakluyt's Voyages, III, p. 276, London, 1810, reprint of edition of 1600.

[3] J. J. Worsae, Nordiske Oldsage, Copenhagen, 1859, p. 39.

[4] Lewis H. Morgan, League of the Iroquois, p. 364, Rochester, 1851.

The Iroquoian pipes present many unusual characteristics and evidence strong local influences exceeded by none on the continent unless it be the curved base mound pipes of Ohio. Fig. 111 is a homely form of pipe of the Iroquoian area, made of an extremely hard-burned dark pottery, containing no visible mixture of tempering material such as is commonly found in aboriginal earthenware vessels. This pipe was found in Chautauqua County, New York, collected by Mr. L. M. Dwight, and is very similar to modern Pueblo specimens, both in its bowl and stem cavities. It is but 2½ inches long and an inch wide, the walls of the bowl being so thick as to leave the opening only half an inch wide, the stem being brought to a point with an opening scarcely an eighth of an inch in diameter, made apparently as are the Pueblo pipes by inserting a stem of grass in the fresh clay and burning it out in the process of roasting the pipe. This specimen is entirely without ornament, and the writer would be inclined to believe that it belonged rather to the Indians of New Mexico than to New York, were it not that the material of Iroquoian pipes is quite often of this hard-burned earthenware. The Iroquoian pipe has a smaller stem opening than those of the Atlantic coast people generally.

Fig. 111.

POTTERY PIPE.

Chautauqua, New York.

Cat. No. 22165, U.S.N.M. Collected by L. M. Dwight.

Iroquoian pipes are not uncommonly found with flaring-topped bowls, such as that in fig. 112, which is a pottery specimen collected by Dr. F. B. Hough at Ellisburg, New York. It has a typical bronze hunting-horn shape, such as could be found among the primitive implements of Scandinavia or the rest of Europe. It may be argued that either of these two pipes would answer Cartier's description of a "Cornet." A somewhat similar pipe is herein illustrated (fig. 229) from Tennessee. In either of these the form of the musical instrument is copied. In almost every pipe of the Iroquoian area may be traced forms distinctly copied from European sources.

Fig. 112.

TRUMPET PIPE.

Ellisburg, New York.

Cat. No. 8893, U.S.N.M. Collected by Dr. F. B. Hough.

Rev. W. M. Beauchamp refers the writer to a pipe of this type from Onondaga County, New York, made from a brownish-yellow stone, on the bowl of which there is a human face facing toward the smoker, and to another clay pipe from Cayuga County, in which the bowl and stem are almost in the same plane, the curve being graceful from one end of

the pipe to the other. Mr. G. H. Perkins illustrates, from the Champlain Valley in Vermont, a pipe of this character made of earthenware, upon the surface of which and partially encircling the center of the pipe, are a number of depressions similar to such as are observed upon the Iroquoian limestone rectangular pipes. The more archaic specimens of this type will be found to approach quite closely the straight tube form. Several with but slight curves to them have been found in Cayuga, Onondaga, and Montgomery counties, New York, with markings and other characteristics peculiar to the Iroquoian pipe, some having no ornamentation, others, only ornamentation of the simplest character, until finally we see the human face in great elaboration.

A gracefully curved pottery pipe, with an ornamentally shaped bowl (fig. 113), is from Fremont, Sandusky County, Ohio, and was collected by L. Lappman. This place is near the head of steamboat navigation on the Sandusky River. This type is referred to by Squier as being found on the site of an old Seneca town in Livingston County, New York.[1] The enlarged bowl is encircled with six incised lines made as if in imitation of cord marks, and at the point where the slight shoulder and smaller part of the bowl join are ten nearly equidistant notches cut into the pottery. They are apparently for ornamentation.

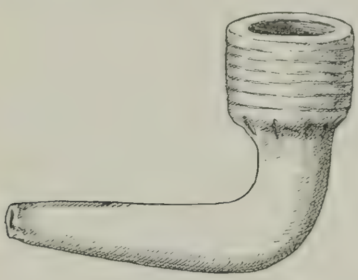

Fig. 113.
IROQUOIAN POTTERY PIPE.
Sandusky County, Ohio.
Cat. No. 45653, U.S.N.M. Collected by L. Lappman.

Morgan refers to the art of making this pottery being lost and says that it was of so fine a texture as to admit of a tolerable polish, the black specimens being so firm as to have the appearance of stone. In some specimens, he remarks, they have in front a human face or the head of a wolf or that of a dog. Of late, he says, the Iroquois cut pipes out of soapstone.[2]

Many of the specimens of Iroquoian clay pipes in the U. S. National Museum are broken. Those which come under the general designation of "trumpet shaped," vary greatly in the curve of the outlines of their bowls, the exteriors of some being round, others square, at other times the sides flare or curl over until they resemble a trumpet. The exterior ornamentation varies as greatly as does the shape of the bowl itself, parallel lines running horizontally, perpendicularly, and diagonally, are constantly encountered and it is not uncommon to find the lines of ornamentation consisting of graceful combinations running in parallel lines or blocks, which, however, seldom or never cross each other, due to some superstition, possibly, in connection therewith. This type is

[1] E. G. Squier, Aboriginal Monuments of New York, p. 76, Smithsonian Contributions to Knowledge, II.

[2] Lewis H. Morgan, League of the Iroquois, p. 355, Rochester, 1851.

found in the Mohawk Valley. Serpent bowls are said by Rev. W. M. Beauchamp to be frequent, and he says the Oneidas were fond of owl's heads, and that sometimes an animal's head was placed above a man's. Mr. E. H. Squier illustrates a clay pipe from Jefferson County, New York, apparently belonging to this class, around the bowl of which two snakes are wrapped in graceful folds, though they do not cross each other. At times there is noted in their bowls a graceful barrel-shaped enlargement, similar in general characteristics to some of the early English tradepipes. The same enlargement of the bowl is also noted commonly in the vase-shaped bowls of pipes intended to be smoked without stems. The flaring bowls are frequently found at Montreal. Mr. Beauchamp calls attention to quite a remarkable clay pipe found in Onondaga County, New York, upon the bowl and stem of which there yet remain fourteen human faces; the stem of this is partly broken off. There are indications that the faces originally extended to the end of the stem.

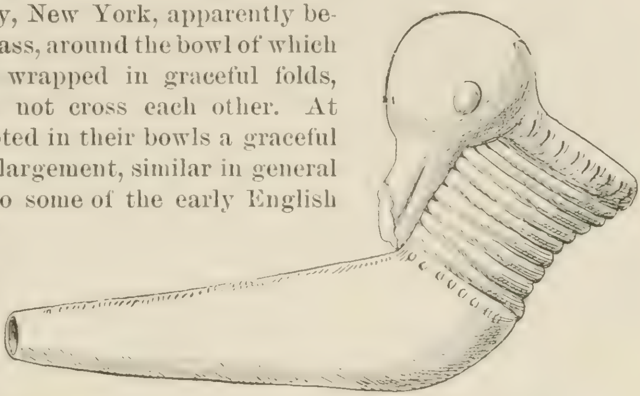

Fig. 114.

IROQUOIAN POTTERY PIGEON PIPE.

Cayuga County, New York.

Collection of W. M. Beauchamp.

Mr. Beauchamp has furnished the writer sketches of pipes that are in his possession from both Cayuga and Onondaga counties, New York, which are strikingly graceful as works of art, especially those representing birds' heads, one of which appears to be a wild pigeon (fig. 114). Another (fig. 115) represents the bowl of the pipe as a pouch of a bird whose double beak reaches quite as far above the bowl as the bowl itself is deep. This pipe differs materially from those found in the Etowah

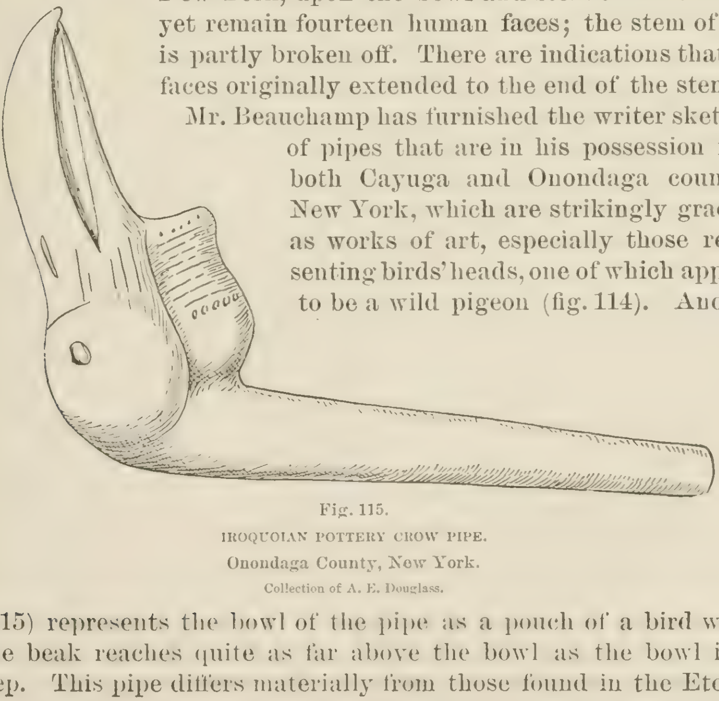

Fig. 115.

IROQUOIAN POTTERY CROW PIPE.

Onondaga County, New York.

Collection of A. E. Douglass.

mound in Georgia, and the Lenoir burial place in North Carolina; yet there is a characteristic similarity in treatment of both types that indicates similar art environments and concepts, which are only reconciled by attributing them to French or English origin. The character of these pipes differs between North and South sufficiently to entitle each to be classed by itself. There are others of these pipes having upon their bowls the heads of animals, differently treated but all of a highly artistic character. These heads commonly face the smoker, but one, representing a panther, faces to the right side. What adds greatly to the artistic effect of this class of pipes is that in addition to the head represented there is a grouping of incised lines, dots, or ellipsoidal depressions, one or other, or a combination of the three, which have a most pleasing effect. Mr. David Boyle, in his Notes on Primitive Man in Ontario, for 1895, has given a number of illustrations of these Iroquoian pipes of clay, and calls attention to the square-topped class, which he attributes to the Hurons "on account of its prevalence in the district occupied by those people."[1]

Many of the pipes illustrated by Mr. Boyle represent the human faces with anything but Indian characteristics; one, apparently that of a woman, is facing the smoker. A second, very similar one, faces from the smoker. A curious specimen illustrated by Mr. Boyle looks like some animal with a bit in its mouth. Two of his illustrations of the pipes of Ontario represent the snake, one being open-mouthed, and in the second, two twined snakes form the bowl. Mr. Boyle considers that there is no evidence that totemism played any part in this department of aboriginal handicraft, and thinks the great variety of human representations would seem to indicate the mere play of fancy in pipe modeling. In some instances he thinks there may have been a secondary reference to totems[2] referring, of course, to Iroquoian types.

Mr. Boyle's recent illustrations of the Iroquoian pipe suggest that the variety of animal forms and human heads and faces was almost endless, though the variety itself is one of the strongest arguments in favor of the European origin and treatment of the pipe. He speaks of great pits of bones containing at times as many as a thousand individuals, being "without an arrowhead, without a pipe, without a pot, or without a scrap of anything to cheer the forlorn ghosts."[3] He also says, in a communication to the writer, that in the oldest graves he had ever opened no pipes appeared, and it is believed that the more carefully the subject is studied the more proof will be found that this type of pipe with elaborate forms modeled upon it dated from late in the seventeenth if not the eighteenth century.

In the etomology of the word "Iroquois" Mr. Hale finds what he believes to be at least a possible origin in the indeterminate form of the

[1] David Boyle. Notes on Primitive Man in Ontario, p. 32, being an appendix to the Report of the Minister of Education for Ontario, Toronto, 1895.

[2] Idem, p. 32. Also, see Reports of 1896 and 1897.

[3] Annual Report of the Archæology of Ontario, 1896–97, Rice Lake, Ontario.

word *garokwa* (pipe or string of tobacco) "ierokwa," "they who smoke," briefly, "tobacco people," the "Iroquois being well known to have cultivated tobacco."[1]

An extremely hard-burned pottery pipe from Massachusetts, collected by Mr. J. H. Devereux, is shown in fig. 116, which evidences a certain relationship to the last illustration, not only in the material from which it is made, but in the partially encircling lines and a row of notches around the shoulder of the bowl where the lines stop, and also in the character of the bowl, stem, and the curve of the pipe. This specimen is about 2½ inches in height and would if whole be about 4 inches long, the diameter of bowl being generally about an inch. A remarkable feature of this pipe is the human figure on the escutcheon or niche facing the smoker, which is a part of the bowl, this being an occurrence not unusual in pipes found throughout an extensive territory bordering on the St. Lawrence. The figure, which is seated, appears to have been stamped in the clay prior to burning, though a number of notches seem to have been cut around the outer frame encircling the figure after the clay was baked. One can scarcely ignore in this pipe the strong resemblance it bears to the pictures and wood carvings of the whites in their churches and elsewhere, the elevation of the rim being strongly indicative of the front of the hat of the grenadier.

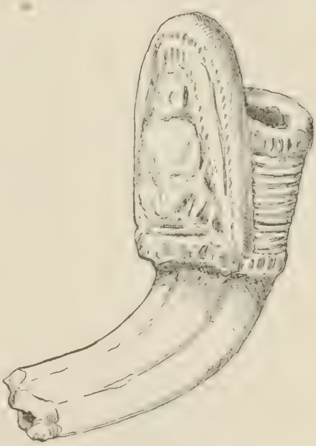

Fig. 116.

IROQUOIS ESCUTCHEON POTTERY PIPE.

Massachusetts.

Cat. No. 6833, U.S.N.M. Collected by J. H. Devereux.

Rev. W. M. Beauchamp, of Baldwinsville, New York, has several examples of this character, found in Jefferson County, New York. The lines commonly encircling the escutcheon are two or three. Mr. David Boyle, of Ontario, finds that the figures usually have the left hand raised to the mouth, the figures themselves being of half or full length, seated or standing.

There are, however, other pottery pipes of the Iroquoian type in which the bowls and stems are almost at right angles to each other and made of stone, that Pierre a Calumet to which Kalm refers in 1749, saying:

"This is the French name of a stone disposed in strata between the lime slate, and of which they make almost all of the tobacco pipe heads in the country. When the stone is long exposed to the open air or heat of the sun it gets a yellow color, but in the inside it is gray. It is a limestone of such compactness that its particles are not distinguishable to the naked eye. It is pretty soft and will bear cut-

[1] J. N. B. Hewitt, American Anthropologist, I, p. 188.

ting with a knife. All the tobacco pipe heads which the common people in Canada make use of are made of this stone, and are ornamented in different ways. A great part of the gentry likewise make use of them, especially when they are on a journey. The Indians have employed this stone for the same purposes for several ages past and have taught it the Europeans. The heads of the tobacco pipes are naturally of a pale gray color, but they are blackened while they are quite new to make them look better. They cover the head all over with grease and hold it over a burning candle or any other fire, by which means it gets a good black color, which is increased by frequent use. The tubes of the pipes are always made of wood."[1]

This stone is found near the Falls of Montmorency, 9 miles below Quebec. In other ways than in the use of the pipe stone "the French in Canada in many respects follow the customs of the Indians. They make use of the tobacco pipes; they mix the same things with tobacco; most of them wear red woolen caps at home and sometimes on their journeys."[2]

Fig. 117 represents a white stalagmite or limestone pipe from Oswego County, New York, collected by Mr. C. Rogers, and appears to be made of the stone referred to by Kalm, it is about 4 inches long and has a well-polished surface. Many of the characteristics of the preceding illustration are encountered here, especially the elevation of bowl, as well as the figure facing the smoker, which in this instance is at full length, and instead of being in relief, as in the pottery specimen, is in intaglio, though it is inclosed in a somewhat similar framework, which has two equidistant lines running up each side of the bowl and continuing from one side of the face to the other across the top above the standing figure. Around the upper part of the bowl are a number of ellipsoidal countersunk depressions of irregular sizes, some of which are square or in shape of a parallelogram with rounded corners, the interior of the depressions not being smoothed, but showing the tool marks left by the implement with which the material was removed. These depressions are among the most striking characteristics of Iroquoian pipes of all shapes, and one of the marks most often encountered in pipes of the area influenced by the Iroquoian Confederacy.

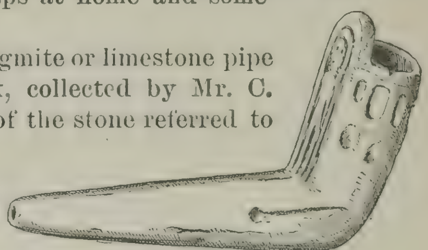

Fig. 117.
IROQUOIS PIPE OF STALAGMITE.
Oswego County, New York.
Cat. No. 26963, U.S.N.M. Collected by C. Rogers.

The Rev. W. M. Beauchamp has in his collection "a dark marble pipe" of this character from Onondaga County, New York, with the same frontal elevation observed in the illustration, though the ornamentation on the side of the bowl away from the smoker differs. Prof. G. H. Perkins illustrates a similar pipe from the Champlain Valley,

[1] Peter Kalm, Travels into North America, III, p. 231, London, 1771.
[2] Idem, III, p. 255.

which is made from clouded gypsum. The depressions upon the surface, he believes, were intended to be inlaid with pieces of other stone, and considers that there can be no doubt of this because of the unfinished state in which these cavities are left, whereas the rest of the pipe is moderately well finished. Several similar pipes are said to have been found on both sides of the lake.[1] An excellent specimen of this type from Cortland County, New York, is in the Douglass collection.

A cast of a pipe of this class from Montreal shows the human face so grotesquely as to represent the front of the skull with its eyeless sockets and cavities, intended for nose and mouth rather than a living face, not only on that part of the bowl facing the smoker, but on its sides as well. Professor Perkins also illustrates a pipe bowl with several of these elliptical or quadrangular depressions excavated, as he thinks, for the purpose of being filled in with ornamental bits of shell or stone. The bowl of the latter has no stem attached and was apparently intended for smoking with a stem.[2]

Bowls of other shapes have been found in New York with these peculiar depressions cut into their surfaces, and Professor Perkins illustrates a pipe of the rectangular type made of pewter, which probably represented, as he suggests, the transition stage of stone from pottery.

The pipes do not fully answer Kalm's description in their stems, and of the known specimens most have been found on the eastern side of the St. Lawrence River and Lakes Ontario and Erie. Professor Perkins illustrates a stemless pipe bowl from Vermont made of "the usual steatite," which in form probably more nearly resembles the pipe Kalm describes than does any other.

Fig. 118.

IROQUOIS POTTERY PIPE.

Bloomfield, New York.

Cat. No. 6184, U.S.N.M. Collected by E. Jewett.

An extremely hard burned black pottery pipe (fig. 118) from Bloomfield, New York, collected by Col. E. Jewett, upon the bowl of which is molded a human face, exhibits apparently European rather than Indian characteristics, and preserves in the shape of the bowl the peculiarities of the "grenadier hat" form, the usual elevation of the bowl being modified in order the more effectually to allow the modeling of the forehead. In the ornamentation of the bowl of this pipe, especially that part of it behind the individual's ear, a number of broad and narrow lines alternating with each other with rows of dots between them are artistically grouped. The ears are distinctly formed and fairly well modeled, and the eyes have been deeply cut into the pottery subsequent to its

[1] G. H. Perkins, The Calumet in the Champlain Valley, Popular Science Monthly, December, 1893, p. 243.

[2] Idem, p. 241.

burning, as though intended to hold artificial pupils of some different material—a not unknown art in American pipes, especially those of the curved base mound type. The mouth is sawed into the pottery, and not modeled in its plastic condition, as are the other features. This type has also been found in Cayuga and Munroe counties, New York.

A well-burned pottery pipe of Iroquoian type (fig. 119) from Watertown, New York, collected by Col. E. Jewett, shows a rude character of unusual ornamentation, not only in its scalloped bowl, but in the enlarged part of the same, decorated by lines cut into the pottery, though type characteristics are preserved. Pipes of this character are found in a variety of forms, having at times molded on the bowl or around it, or on top of it, the figures of men or animals, including both the grave and grotesque, yet often they are executed with a degree of skill more nearly akin to the higher European art than to that of savages, who, unless they did so in their pipes, do not appear to have produced a single figure carved in the round, except of the rudest character.

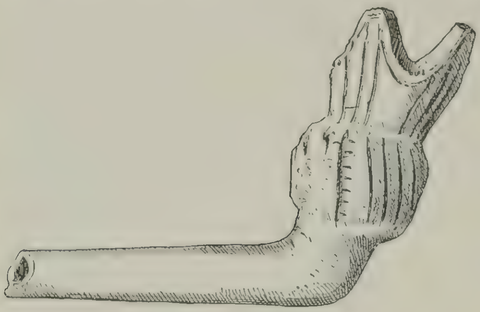

Fig. 119.

IROQUOIS POTTERY PIPE.

Watertown, New York.

Cat. No. 6187, U.S.N.M. Collected by E. Jewett.

Pipes of this type, having square tops to the bowls, belong to the Hurons, according to Mr. David Boyle, of Toronto, one of which, from Fox River of the Illinois, found in a mound in Wisconsin, is figured by him. These, Lapham says, were so small as to suggest that they were articles of fancy rather than of use.[1]

One of these square-topped pipes showing Iroquoian ornamentation was shown to Mr. H. R. Schoolcraft by a chief of Rivière Au Sable, at Thunder Bay, Michigan, on the mainland, as an antique pipe, which the chief averred was smoked by his ancestors.[2] Dawson illustrates a similar specimen from Montreal.

Schoolcraft is probably right in his assertion that though they were attributed to the skill of the American Indians they were not in any instance due to these tribes, but were made for the Indian trade.[3]

This will probably apply with equal force to all these hard-burned clay pipes of Iroquoian type having upon them such varied ornamentation as the representations of men, birds, and animals.

Fig. 120 is a fragment of a small pipe of pottery, from Honeoye

[1] I. A. Lapham, Antiquities of Wisconsin, p. 82, Smithsonian Contributions to Knowledge, VII.

[2] North American Indian Tribes, Pt. 1, p. 75, plate VIII, fig. 1.

[3] Idem, Pt. 4, p. 140.

Falls, Monroe County, New York, collected by Mr. William M. Locke. It is quite small, and shows in what a variety of ornamentation the people making these pipes indulged. Though the animal is not sufficiently well modeled to distinguish whether a mouse or a fox, the eyes, ears, and legs are attached to a rude modeling, indicating a type of art different from what would be expected of a people living in the purest savage state, as the Indians of this region did at the time of first contact with Europeans.

Fig. 120.
IROQUOIS POTTERY PIPE.
Honeoye Falls, New York.
Cat. No. 31497, U.S.N.M. Collected by William M. Locke.

Squier and Davis illustrate an Iroquoian pottery pipe plowed up in West Virginia, nearly opposite the mouth of the Hocking River, where there are abundant traces of an ancient people in the form of mounds, embankments, etc.;[1] on the bowl there is an animal's head which faces from the smoker, and which, judging from the illustration, belongs to the Iroquoian type, not only in shape, but in ornamentation of the bowl as well. While this latter pipe is from a locality quite distant from where similar ones are commonly found, it is within the area influenced to a certain extent by French trade.

On the bowl of one of these pottery pipes was modeled a panther's head facing to the right. Others have been found with heads facing from the smoker, and a singular specimen was discovered representing the caricature of a human head and face, the mouth of which is drawn to one side, the eyes closed, and the side of one jaw badly swollen as if from toothache.

BIRD PIPES.

A curious pipe of pronounced type (fig. 121) was found in a mound on the banks of the Ohio River in Allegheny County, Pennsylvania, and collected by Mr. P. Painter, which has an outline that would indicate a bird sitting upon a perch or limb. It is 5½ inches high and appears to be made of a compact black slate, which has been badly cracked by other heat than that generated in smoking it. The eyes are represented by two depressions, the feet by a knob, and, except that the head has been shaped, the rest of the body is perfectly smooth, and in cross section a parallelogram. The only tool marks visible are apparently those of a file across the top of the bowl. Pipes of this type had, as a matter of course, to be smoked with a wooden or other stem. The feet of the bird in these pipes are at times perforated for the attachment of a cord, or the knob is sufficiently shouldered to answer the same purpose, the bowl and stem openings being of like size, and drilled each one-half inch in diameter. One of these pipes (Cat. No. 32297, U.S.N.M.) was found in Onondaga County, New York.

[1] Ancient Monuments of the Mississippi Valley, p. 194.

The feathers of the bird are rudely indicated, and around the neck there is a necklace of beads carved into the stone. Mr. Boyle refers the writer to another pipe of this type in form of a dog or monkey, which was found in Ontario, having a hole for the string bored through the base of the figure. A pipe of similar type in possession of Rev. W. M. Beauchamp, from Oneida River, New York, represents a bird with topknot or comb, the wings being indicated by incised lines, the material of the pipe being black slate. A specimen in the collection of Mr. O. M. Bigelow, made also of slate, has what appears to be wings cut in regular conventional lines, though the head may as well be called a turtle as a bird. The feet of the last two pipes referred to are bored from side to side; upon the first there is on the back of the neck a heart-shaped ornament. Still another of these bird pipes from Onondaga County, New York, has upon its sides the ellipsoidal depressions so often noticed in Iroquoian pottery and stone pipes. Mr. Beauchamp suggests that these pipes were made with metallic tools. There is also in the U. S. National Museum collection (Cat. No. 32342) a cast of a most curious pipe of this type, the original of which is said to be of magnesian limestone, in shape of a dog, and is from New York, though the figure is so carved that it is possible the intention was to represent the skeleton of some animal. A beautifully executed pipe of this character, having all the characteristics of the northern specimens, made from a light brown, highly-polished stone, and upon which the wing and tail feathers are conventionally represented, is in the collection of the University of Pennsylvania, and is said to be from the coast of Florida, which is, however, so far from the known locality where these pipes are usually found as to suggest its having been lost by some white person who had obtained it in the north.

Fig. 121.

STONE BIRD PIPE.

Allegheny County, Pennsylvania.

Cat. No. 15031, U.S.N.M.
Collected by P. Painter.

Yet another pipe, apparently of this type, was found at North Carver, Plymouth County, Massachusetts, and is illustrated by Dr. Charles C. Abbott.[1]

This pipe has been attributed to the people of the Pacific coast, and is supposed to have been brought across the continent. Its characteristics and style of workmanship are strikingly like those of certain of the Pacific coast tribes, though if the specimen be compared with others of the type, there is scarcely room to question its eastern northern origin.

Mr. David Boyle illustrates a slate specimen from Victoria County, Ontario, with a well-carved beak and mouth; though by far the most curious pipes of this type are two illustrated by Mr. Boyle, from Victo-

[1] Primitive Industry, p. 324, fig. 318, Salem, 1881.

ria County, Ontario, which represent some creature climbing a pole, and are strikingly similar to the familiar toy known as a "jumping jack."

Fig. 122, from Erie County, Pennsylvania, collected by Mr. J. H. Devereux, is 5 inches in height and is clearly of this type, being made of a very imperfectly crystallized quartzite, the surface of which is so rough that it would be impossible to represent eyes or feathers, no matter what tools were employed, the bowl and stem holes being of the same size, namely, one-half inch, which is a striking feature of pipes of this type. The localities where they are found, with the one exception noted, are all contiguous to the St. Lawrence, the line of the Great Lakes, and their tributaries—all well within that of Iroquoian ethnic relationship—yet with all this in favor of their aboriginal origin, there is a very general belief in their being of European manufacture, or at least made with the implements of the European.

Fig. 122.

STONE BIRD PIPE.

Erie County, Pennsylvania.

Cat. No. [illegible], U.S.N.M. Collected by J. H. Devereux.

In an examination of the English trade pipe, both in Europe and America, there is found such similarity to American forms as to leave little room to doubt that there is sufficient likeness between the two to establish a common origin. The writer is, however, inclined to credit the origin of the type to the English rather than to the native American, though the Dutch and French appear early to have manufactured this pipe, and as some of the early French specimens are extremely archaic, it is possible that the Spanish may have employed it earlier than either. The readiness and cheapness with which Europeans were enabled to mold, burn, and sell the trade pipe caused it to be produced in great quantities, and the trader could afford to sell it at a price which brought it within the reach of all. When, in consequence of English cultivation, the colonists furnished an abundant supply of tobacco there was no longer difficulty in the Indian obtaining all that he wanted, for, notwithstanding the references to primitive cultivation by the natives, their fields appear to have been at best but insignificant in comparison to their actual requirements.

The pipe of the French region of influence along the banks of the St. Lawrence River differed from that of the territory dominated by the English to the east and south of them, the French pipe, as a rule, being more elaborate than that of their rivals in trade. They are more graceful in form and more artistic in design. The pipes of the French area of influence appear often to be trumpet shaped, though there are other types which have quite as distinct individuality and are scattered over a wide area. The calumet, now everywhere known also as the "peace pipe," apparently derives its name from the *chalumeau*, a musical

instrument on the order of the flageolet, called by the English "chalmy." This instrument in turn obtains its name from the same Norman word, signifying a reed.

The long voyages from Europe to America during the sixteenth and seventeenth centuries must have been monotonous in the extreme until the navigators fell in with the land, and even as early as the time of Cicero he informs us there was not a vessel where music was not employed on shipboard to relieve the monotony of the voyage.[1]

Instrumental music was as astonishing to the natives as was the noise of the guns, and must have afforded to these children of the forest remarkable entertainment as well as great astonishment. Nothing is more natural than that the original tubular pipe should have been given the flaring mouth of the metal horn of the French, which, as a pipe, would be further improved by imitating the curve of the horn.

A sort of flageolet referred to by Sir John Hawkins was a musical instrument of which, in an account of Queen Elizabeth's annual expense published by Peck in his Disiderata Curiosa, he speaks of as being "filled with air blown into them by the mouth." He alludes to several of them by name, especially the chalmy, i. e., the *Chalumeau*.[2]

The illustration given by Hawkins is that of a straight instrument, similar to a flageolet and having a flaring mouth like fig. 112.

According to McCulloh, the calumet "which is a Norman word signifying a reed, is a tobacco pipe whose stem is about 4 feet in length, sometimes round and at other times flat. It is painted and adorned with hair, porcupine quills, dyed of various colors, and the most beautiful feathers that can be procured. The bowl of the pipe is most frequently red marble, though some tribes only admit of white stone, and if it be presented to them either of black or red color will have it whitened before they smoke it. It is considered a sacred or consecrated object, and on this account is never suffered to touch the ground, being laid upon two forked sticks, stuck upright in the earth for that purpose."[3]

CALUMET AND WAMPUM.

The illustration here given (fig. 123) shows the calumet with all of its ornamentation as used by the Omahas. To dance the calumet "is to make a sacred kinship, which is done after serious consultation in which the party selected is sometimes advised against doing so, because the party to be danced for is either not worthy of it or he may himself refuse to be adopted in the dance. If all is agreeable, all parties repair to a particular place, where the pipes are placed on a forked support. Instead of the pipe bowl there is the head of a green-necked duck; on the upper side of the stem are yellowish feathers of the great owl;

[1] J. B. De La Bord and P. J. Roussieu, Essai sur La Musique, II, p. 211, Paris, 1780.

[2] Sir John Hawkins, A General History of Music, II, p. 450, London, 1776.

[3] J. H. McCulloh, Researches, p. 144, Baltimore, 1829.

next long wing feathers of the great war eagle, split and stuck on longitudinally in three places, as on an arrow shaft. At the end of these is some horsehair which has been reddened. It is wrapped on the stem and tied on with sinew and over that is fastened some of the fur of the white rabbit; near one end is the head of a woodcock * * * the nose turned toward the mouthpiece. On the pipe the eagle feathers are white, being those of a male eagle, and the pipe stem is dark blue."[1]

Fig. 123.
CALUMET.
After J. Owen Dorsey, Third Annual Report of the Bureau of Ethnology, p. 277.

As seen in fig. 124, "When the pipes are rested against the forked stick the head of the duck is placed next the ground. The sticks are colored with Indian red. The next morning before sunrise some of the visitors sing for the people to arise and assemble. When they begin to sing, the pipes are taken from their support and are not returned until the singing is concluded. They sing again after breakfast, a third time in the afternoon, and once more at night. This generally continues for two days, during which time the visitors are feasted. Sometimes they continue the feast for three days. The day after the feast they give and receive presents. The next day a servant of one of the principal visitors is selected to dance, one who is skillful in imitating the movements of the war eagle. The person danced for is thereafter adopted as a member of the family of the other. The Ponkas are not fully acquainted with the calumet dance. They use but one pipe; but the Omahas always have two pipes."[2] This description of the dance and of the pipe and the decorations of the pipe are similar to the earliest accounts we have. The stem of a pipe brought from the Lower Niger, Africa, by Captain Burton, which is in the collection of the British Museum, with its carefully attached tufts, resembles stems employed by American Indians.[3]

[1] J. Owen Dorsey, Omaha Sociology, Third Annual Report of the Bureau of Ethnology, p. 277, fig. 20.

[2] Idem, pp. 276–282.

[3] R. T. Pritchett, Ye Smokiana, p. 33, 1890.

The friendly offering of the pipe is evidently an ancient custom, and one referred to by many of the earliest visitors to the Atlantic Coast, though in council the pipe does not appear to have been so prominent an adjunct in the East as it was in the Valley of the Mississippi, where in all functions between the French and the natives the calumet occupied an important position.

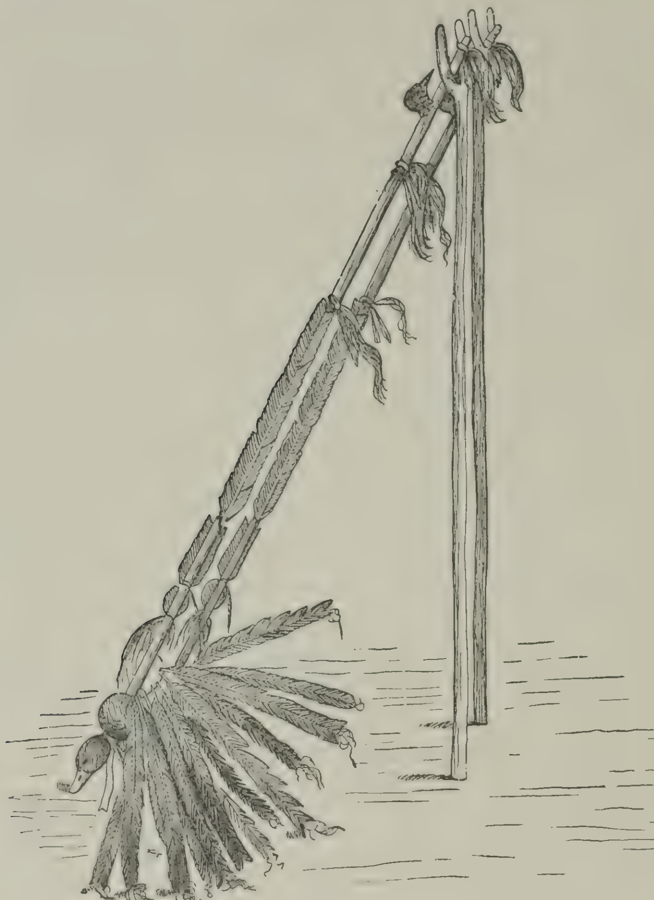

Fig. 124.

CALUMET DANCE.

After J. Owen Dorsey, Third Annual Report of the Bureau of Ethnology, p. 276.

Except by means of the rudest pictography the North American native had no means of recording events. Some method became necessary in their dealings, particularly with the whites, to evidence engagements on the one part and the other, whether affecting the tribe, as in treaties, or between individuals, as in simple contracts, memory alone being too unreliable without extraneous symbols. Among the English, in their early dealings, the "wampum belt" or necklace, consisting

originally of beads of wood or shell, and later of bands of shell, and still later of china or glass beads worked into bands, or belts, as they were commonly called, arranged in rude order, were employed, a simple example of which, represented in fig. 125, after Rev. W. M. Beauchamp, is formed of "white beads on a dark background." The long house represents the Five Nations, and the cross the French.[1]

The design of this belt, which appears to have succeeded the string of wampum, varied according to the occasion, and was intended to remind those presenting it, as well as those who received it, of what was agreed upon at the time of its presentation or exchange. Instead of the belt the French, from the earliest period of their intercourse with the natives, adopted the pipe ceremony in council, as well as in their trading, in which invariably the pipe had to be smoked before any serious business could be undertaken. In the early French records there is abundant evidence that the pipe was considered as similar to the flag of truce, and protected its bearer under all circumstances. Later the pipe and belt of wampum, especially with the great Iroquoian Confederacy of the Five and later the Six Nations, appear to have been employed in conjunction with each other. When the English were holding a

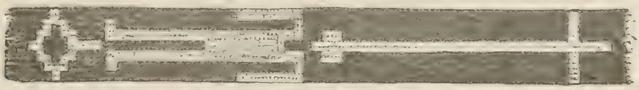

Fig. 125.

WAMPUM BELT.

After W. M. Beauchamp.

council with the natives the belt was most important, whereas if the deliberations were with the French it was the pipe that was most significant. Still later the Americans appear to have supplanted the pipe of the French with the American flag, or more often with medals stamped with the head of the President of the United States. Prior to the advent of the whites some interchange of commodities in the way of trade appears to have existed between the natives. Even during times of hostility the trader has been allowed to travel back and forth with his articles of exchange with little danger. The religious sentiment was of the crudest character among the Indians, and was little, if at all, superior to the fetish worship of the African. Hunger, climate, and variation of seasons necessitated constant movement in search of game, fish, and peltries, for the Indian had learned but the rudiments of the cultivation of soil. Expert as a hunter, able to track his prey, whether man or beast, with an accuracy surprising to the whites, he was not a herdsman. He migrated with the buffalo. Agriculture was almost an unknown art to him. His boundaries were only limited by the presence in a given area of a more powerful neighbor who was ever ready and anxious to resent a trespass on his territory or the slaughter of his game.

[1] W. M. Beauchamp, Smithsonian Report, 1879, p. 390, fig. 1.

"The name 'calumet' pipes has been given," according to Dr. Rau, "to large stone pipes, which were smoked with a stem, and are usually fashioned in imitation of a bird, mammal, or amphibian, and sometimes of the human figure. They were thus called on account of their bulk, which seemed to indicate their character as pipes of ceremony to be used on solemn occasions. It was further thought that these pipes had not been the property of individuals, but of communities, a view which does not seem altogether correct, since some have been discovered in burial mounds accompanying a single individual."[1]

This word has been so extensively used, first by the French and subsequently by the English, that, whatever its original meaning, it may be said that at present it signifies merely a pipe. There were calumets of war, of peace, of the dance, of confederacy, of the clan, of the cult, and of the individual. To-day a red Siouan catlinite rectangular pipe would more correctly represent a calumet than any other single type. Pipes were of many different sizes and of different shapes with each affiliated tribe, the larger ones usually being employed when the interests of tribe or confederacy were involved, whereas the straight tube appears to be the pipe of the dance and solemn sacred functions.

The calumet of peace, according to the French missionaries, was accepted as a flag of truce by the Indians from Lake Michigan far down the Mississippi River from 1673 for many decades. According to Morgan, "the Iroquois believed that tobacco was given to them as the means of communication with the spiritual world. By burning it they could send up their petitions with its ascending incense to the Great Spirit, and render their acknowledgments acceptably for His blessings."[2]

At the sacrifice of the white dog among the Sioux the speaker "threw leaves of tobacco into the fire from time to time, that its incense might constantly ascend during the whole of the address."[3]

The pipe among the Indians of Canada, as elsewhere, was used also upon ordinary social occasions, though there is reason to believe that the pipe ceremony always had some special significance other than that of a mere social acknowledgment or sedative. It brought luck or kept away evil spirits. It was smoked to bring game, or keep off disease, and to attract or repel the mysterious powers of their mythology. Among the Mandans, "if a woman passes between several men of the tribe who are smoking together, it is a bad omen. Should a woman recline on the ground between men who are smoking, a piece of wood is laid across her to serve as a communication between the men. When any person had a painful or diseased place, a man put his pipe upon it and smoked. On such occasion he did not swallow the smoke, as is the Indian custom, but he affirmed he could extract the disease by his

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[1] Charles Rau, The Archæological Collections of the United States National Museum, p. 48.

[2] Lewis H. Morgan, League of the Iroquois, p. 164, Rochester, 1851.

[3] Idem, p. 219.

smoking, and he pretended to seize it in his hand and throw it into the fire."[1]

Wherever there are accounts of early Spanish or French travels among the American Indians we find the cross played an important part. The Spanish upon entering a town or village invariably erected a cross the first thing they did. The French missionaries, besides carrying prominently the cross as a part of their visible equipment, did their best to impress upon the natives its great importance. Consequently we find it prominent among aboriginal decorations: it is seen on the wampum belt, upon inscribed shells, on pipes, etc. Cabeça de Vaca, in his wonderful adventures among the people of the territory then called Florida, cured the natives by making the sign of the cross. In a mound within the limits of Chillicothe was found, "in a small inclosure near by, a silver cross of French origin."[2]

Upon another occasion "two silver crosses were taken in November, 1839, from a grave mound at Coosawattee, old town in Murray County, Georgia, associated with Indian implements."[3] and other occurrences could be enumerated showing the contemporaneity of the crosses with pure savage conditions.

"In a conference to make peace a single person is never sent: there must be two; but depending upon the strength of those conferring there may be fifteen or twenty. There is, however, one who delivers the strings and belts of wampum; the others listen to his words and remind him when he forgets something. One of the ambassadors carries the peace pipe in advance to the Indians—the same as a flag of truce is to the Europeans. The respect in which the embassy is held is so great that a person disregarding it would not fail to be punished by the Great Spirit. It is only used in negotiating treaties. This pipe, called calumet by the French, usually had a head of red marble, the red color being the sign of blood. It is never sent as a peace offering without being covered with white clay or chalk. Such a pipe head is 6 to 8 inches wide and 3 inches high. The stem is of hard wood and 4 feet long, covered with beautiful bandages interwoven with white coral, in which work the Indian women endeavor to show their skill. These stems are often ornamented with porcupine quills, or green, yellow, or white feathers. Near the village of the party opposed to them the envoys commence to sing and dance, and are carried to the dwelling of the head chief, where every attention is shown them so long as the negotiations last. The opening of the proceedings is performed by the head chief of the envoys taking a whiff from the peace pipe and blowing

[1] J. Owen Dorsey, A Study of Siouan Cults, Eleventh Annual Report of the Bureau of Ethnology, p. 511.

[2] Squier and Davis, Ancient Monuments of the Mississippi Valley, p. 166, Smithsonian Contributions to Knowledge, I.

[3] Charles C. Jones, Silver Crosses from an Indian Grave-mound at Coosawattee Old Town, Murray County, Georgia, Smithsonian Report, 1881, p. 619.

to the skies and to the earth. It is then smoked in succession by the whole assembly, each person holding it with great care."[1]

Among the Indian tribes generally only the more important chiefs are considered worthy of carrying the pipe of ceremony. "Among the Crees the calumet is borne by a man who is solemnly elected to the office and who has to pay rather dearly for the honor, from 15 to 20 horses being the usual fee which each pipe bearer presents to his predecessor on receiving the insignia of office; these, however, are of considerable intrinsic value. They include a bearskin, on which the pipestem rests when uncovered; a beautiful painted skin tent, in which he is expected to reside; a medicine rattle of singular value; a food bowl, and other articles so numerous that two horses are needed to carry them."[2]

Among the Ojibways "next in importance to the war chief was the pipe bearer, who officiated in all public councils."[3]

On April 7, 1536, within one mile of Tadousac, below the mouth of the Saguenay, Lescarbot says: "Having landed, we went to the cabin of their sagamo, called Anedabijou, where we found him with eighty or one hundred of his companions 'qui fasait tabagio,' which means feasting."[4] He says this savage commenced to take petun (tobacco) "and gave it to the Sieur Du Pont and to me and to some other sagamos near him, and having taken a good smoke began his speech (id). From this time on the French advanced up the St. Lawrence, or River of France, as they called it, until they reached Lake Ontario, and from thence to Erie, and each year went further as they became acquainted with the Indians of the more distant parts until Marquette and Joliet, in 1673, reached the Mississippi near Lake Michigan. De Soto landed in Florida in May, 1539, and reached the banks of the Lower Mississippi in 1541. La Salle came into the mouth of the Mississippi in 1682 and took possession in the name of the King of France. The Chevalier de Tonti had gone down the Mississippi River as far as Balize in 1685 to meet La Salle, whom he missed. Iberville and Bienville, in 1699, entered the Mississippi and went up it as far as the mouth of the Red River and the next year met Tonti 50 miles from the mouth. He had come from Canada down the river, being the second trip which he had made."[5]

MOUND PIPES.

Throughout a large portion of the United States earthworks are found of various kinds, attributed to different periods of antiquity. The mounds and embankments are especially numerous in the State of

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[1] Loskiel, Geschichte der Mission der Evangelischer Brüdern, p. 201, Barby, 1789.

[2] J. G. Wood, The Natural History of Man, p. 682, London, 1870.

[3] William W. Warren, Minnesota Historical Collections, V, p. 318.

[4] Marc Lescarbot, Histoire de la Nouvelle France, Book III, p. 288, Paris, 1608.

[5] Charles Gayare, Louisiana, its Colonial History and Romance, New York, 1851.

Ohio, where there have been discovered aboriginal remains of the most interesting character. The controversy as to the origin of these mounds and of the people who built them and of their age is one most difficult of satisfactory solution. They are by no means confined to the United States, and as to whether the people who constructed them continued to do so up to a comparatively modern date or whether they are all of great antiquity is and has long been a matter of dispute among archæologists. The remains found in the mounds consequently have been by many attributed to a people of great antiquity, antedating the present Indian race, and many scientific papers have been written in support of this theory. Yet there are those living who have witnessed the building of mounds, and the extensive studies of Prof. Cyrus Thomas, of the Bureau of American Ethnology, induce him to believe that the Cherokees were mound-builders up to and since the arrival of the whites on the continent. Many articles of modern make, undoubtedly the handiwork of the white people, have been found buried in the mounds. Such things are declared by some to be intrusive or secondary burials. They are alleged by others to have been deposited therein at the time of the construction of the tumuli. With hardly an exception all earthworks of every description found in the interior of the country are attributed to this wonderful ancient race of aboriginees. Though the very country where mounds are most abundant was the battleground of French, English, and Indians for many decades in the struggles waged between the English and French for the possession of the Indian trade, some of these supposed aboriginal earthworks may well have been the fortified camps of one or other of the white invaders. The mounds are found almost invariably along the lines of the great rivers of the interior, due, presumably, to the fact that these rivers were the lines ot least resistance to the free communication from one point to the other, and consequently were the trade routes of the interior, whether of white man or Indian. It has been said of the mound-builders that they were very numerous throughout the Mississippi Valley. "They were a people entirely distinct from the North American Indian. The pipes are often elaborately and beautifully carved of a great variety of stones, generally of rather a soft character, and were apparently held in very high estimation, perhaps almost sacred. In the Upper Mississippi Valley they are of the same general type, having the flat curved base, which is perforated to serve as a stem. They represent a variety of forms, among them two said to distinctly represent the elephant."[1]

The best known work on the mound-builders' pipes is that of Messrs. E. G. Squier and E. H. Davis in the Ancient Monuments of the Mississippi Valley, contained in the first volume of the Smithsonian Contributions to Knowledge, which described explorations of these remains

[1] Extract from President Pratt's Report, Davenport Academy of Natural Sciences, American Naturalist, XIII, p. 684.

through a period of years. In this publication there are illustrations of the objects discovered, and nothing is more striking than the pipes. These are quite numerous, and represent not only man, but many of the mammals, birds, and even reptiles, and, indeed, many of them are executed with skill and striking artistic effect, though there may be room for doubt whether the figures represent as many different species as some have believed. In intricacy of design, in artistic concept, in skill of execution, in truthfulness to nature, it must be admitted that the work of the modern Indian on his pipe, when compared with that of the mound-builder, would demonstrate that the historic Indian was the equal of the supposed earlier race. There is no doubt whatever that pipe-carving constitutes the best example of aboriginal art, though how far it was influenced by the whites is a question subject to difference of opinion. In view of the fact, which is sustained by all writers, colonial and modern, that to the whole Indian race the pipe was an object used in religious functions, for medicinal purposes, in tribal treaties, as well as upon all social occasions, it is natural to see artistic influences developed in the pipe; this is more especially to be expected when we know that the totem of clan or tribe ranked as high as anything could in the Indian imagination. Yet it is quite another and more doubtful proposition to attribute to the Indian the amount of artistic skill evidenced in the forms of the mound pipes. These pipes are composed of stones, the stem holes being extremely small and perfectly straight, and leave but little doubt that the pipes were smoked without a stem other than that comprised in the stone itself. It will be appreciated how numerous the totems of a tribe were when we compare the known clans among pueblo tribes with the figures represented upon the mound pipes, which were probably totemic. The animal kingdom represented among the totems of these people includes the ant, antelope, badger, bear, bluebird, buffalo, chaparal-cock, coyote, crane, crow, deer, dove, duck, eagle, frog, goose, gopher, hawk, humming bird, lizard, martin, mole, mountain lion, parrot, snake, swallow, turkey, and wolf, not to mention the many totems representing inanimate objects, such as arrows, axes, calabash, coral, corn, cottonwood, earth, feather, flower, grass, ivy oak, piñon, shell, stone, tobacco, and water willow.[1]

The largest number of mound pipes ever discovered were found in a mound near Chillicothe, Ohio, by Squier and Davis, designated by them as Mound No. 8, where about two hundred were brought to light. This mound is small in size, and exhibits in its structure nothing remarkable.

"The bowls of most of the pipes are carved in miniature figures of animals, birds, reptiles, etc. All of them are executed with strict fidelity to nature and with exquisite skill. The otter is shown in characteristic attitude, holding a fish in his mouth; the heron also holds a fish, the hawk grasps a small bird in its talons, which it tears with its

[1] F. W. Hodge, Pueblo Clan Names, American Anthropologist, October, 1896, p. 345.

beak. The panther, the bear, the wolf, the beaver, the otter, the squirrel, the raccoon, the hawk, the heron, crow, swallow, buzzard, paroquet, toucan, and other indigenous and southern birds, the turtle, the frog, toad, rattlesnake, etc., are recognized at first glance. But the most interesting and valuable in the list are a number of sculptured heads, no doubt faithfully representing the predominant physical features of the ancient people by whom they were made."[1]

These views have been generally accepted since the publication of this great monograph, which represented the most extensive excavation undertaken by any archaeologist up to its date, though other and more extensive investigations have since been made in these and in other mounds. The accepted theory has for a long period been that the American Indian lavished his utmost skill upon the construction and decoration of his pipe—those of stone as well as those of pottery. Of the latter, Sir John Lubbock has remarked that, "Among the most characteristic specimens of ancient American pottery are the pipes. Many are spirited representations of animals, such as the beaver, otter, etc."[2]

It does not appear to have been considered remarkable that the carving of pipes with such great skill should be practically the only example of American Indian art; and it may be questioned if the small size of the pipes, thereby enabling them to be carried by their owners, sufficiently explains why pipes alone show this skill, fine carving being almost, if not entirely, unknown in other aboriginal stone objects from the area where these pipes are most often found.

It may with pertinence be asked why do we not find in the mounds other images of stone finished with the skill of the mound pipe if they are of Indian origin? The religious or superstitious feeling of the seventeenth century would draw the line at idol making, whereas pipe manufacture would be a legitimate occupation. That the people of the mound-pipe region possessed idols is a historic fact, for Dablon, the Jesuit missionary (about 1670–1672) at Fox River, found an Indian idol on the bank similar to that which Dollier and Gallinée found at Detroit, being merely a rock bearing some resemblance to a man and hideously painted[3] which they threw into the river; the rude possession of those people of whom Le Jeune said, in 1633, "Unhappy infidels, who spend their life in smoke and their eternity in flames."[4]

Mound pipes vary greatly in their finish, yet they are of a distinct type from all other pipes, many of their bowl cavities being small in proportion to their exterior diameter; yet there are exceptions to the rule. The specimens in the Smithsonian collection vary in length from 2 to 5 inches, in height from 1 to 2 inches, and in width from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches.

[1] Squier and Davis, Ancient Monuments of the Mississippi Valley, p. 152, 1848.

[2] Sir John Lubbock, Prehistoric Times, p. 258, New York, 1872.

[3] Francis Parkman, The Jesuits in America, p. 35, Boston, 1895.

[4] Idem, p. 36, Boston, 1895.

The bases of them all appear to curve longitudinally; the upper side of the platform composing the base usually presents a convex surface from side to side, though at times it is perfectly flat, or, rarely, it may be found showing a slightly concave surface. The simplest form of this pipe resembles in outline that of the lip ornament of the Eskimo, the bowl being urn-shaped, with a more or less pronounced flaring top, which would indicate a probable acquaintance with pottery. The tops of the bowls and their exterior rims are at times decorated with a row of dots, or it may be an encircling straight line or lines. The interiors of bowls are, with rare exceptions, of great uniformity, their exteriors varying from specimens with perfectly smooth surfaces to those in imitation of numerous members of the animal kingdom, including man and the elephant.

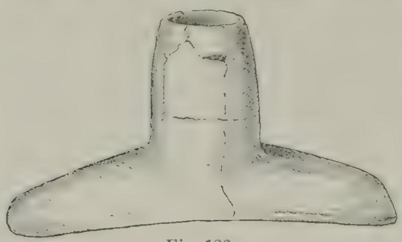

Fig. 126.

MOUND PIPE.

Clark County, Ohio.

Cat. No. 42667, U.S.N.M. Collected by G. L. Febiger.

The most simple specimen of the typical mound pipe is seen in fig. 126, found in a mound in Clark County, Ohio, collected by G. L. Febiger, United States Army, and is composed of a soft white stone—possibly limestone. It is 4 inches long, with a height of 2 inches, the base being $1\frac{7}{8}$ inches broad. The interior of the bowl has a uniform diameter of seven-eighths of an inch its whole depth, and appears to be bored by means of a tubular drill, though the stem seems to have been bored by means of a solid drill, the hole being one-eighth of an inch in diameter. These proportions are practically constant in the mound pipes. Though this pipe has been badly broken, its several pieces have been preserved and carefully glued in place. The specimen is typical and simple, entirely without ornament, its surface having been brought to a uniform smoothness, though the marks of a file on the bowl and stem are in places almost too distinct to be mistaken. These marks consist of a series of lines of equal length on apparently flat surfaces, all equidistant, which the writer has been unable to imitate in any way except by means of the metal file, various kinds of sandstone and quartzite being tried with unsatisfactory results.

Fig. 127.

MOUND PIPE.

Marietta, Ohio.

Cat. No. 5481, U.S.N.M. Collected by J. Varden.

A dark green steatite (fig. 127) from Marietta, Ohio, collected by

Mr. J. Varden, is 2¼ inches long, with part of the base broken off. It is 1½ inches high and has a width of three-fourths of an inch. Though the base of this pipe is slightly more convex than the preceding figure and the bowl more urn-shaped, the type remains the same, the bowl cavity being of uniform size its whole depth, though the stem hole is slightly in excess of that of the preceding figure. The walls of the bowl of this pipe are extremely thin, the bowl cavity being ellipsoidal, rather than cylindrical. The file marks on this pipe are also quite as distinct as they are on the preceding specimen. McLean illustrates a similar pipe as of the genuine mound-builder type.[1]

There was also found in a mound in Laporte County, Indiana, one of the curved-base urn-bowled pipes, and in the same mound with a single skeleton were two copper needles, a copper chisel, four flints, and some pottery. A very similar specimen is in the Davenport Academy of Sciences, which was found in Calhoun County, Illinois, and quite recently a very perfect specimen, made apparently of a mottled gray and white stone, was taken from a mound near Evart, Michigan, and is the property of Miss Helen A. Hepburn.

Mr. John G. Henderson found a similar pipe in a mound at Naples, Illinois, near the Illinois River, made of a white stone, and from the same mound were taken two copper celts, one of which weighed 7½ pounds,[2] and another is reported from Davenport, Scott County, Iowa.[3]

Mr. Warren K. Morehead excavated an unfinished catlinite pipe of this type with the curved base characteristics at Fort Ancient, Ohio, which shows distinctly the process of manufacturing indurated clay pipes, which was by pecking or battering the stone with a stone hammer, as was demonstrably the process of working those stones not readily shaped by chipping.[4] One was taken from a mound at Toolsboro, Louisa County, Iowa, made of "a soft whitish stone,"[5] and yet another unfinished specimen is in the U. S. National Museum (Cat. No. 58650) from Sauk County, Wisconsin, which adds materially to our knowledge of the process of manufacturing these pipes, the surface being apparently ground with sand, or a sandstone, as is evidenced by the striæ left by the tool, which are yet discernible. The bowl of this pipe has, however, been excavated by a solid drill used with sand. The base is broken in process of manufacture, owing to which the bowl has been finished less than the necessary depth, which accounts for its being discarded. The base also is flat, though such specimens are not unusual, Mr. Gerard Fowke having found one in a mound in Page County, Virginia.[6] Moorehead records one from the Hopewell group of mounds in Ohio.[7]

[1] J. P. McLean, The Mound-Builders, p. 165, fig. 38, Cincinnati, 1879.

[2] Smithsonian Report, 1882, p. 697, fig. 14*b*.

[3] W. H. Pratt, Proceedings, Davenport Academy of Natural Sciences, I, p. 117.

[4] Fort Ancient, p. 110, plate XXXIII, Cincinnati.

[5] W. H. Pratt, Proceedings, Davenport Academy of Natural Sciences, I, p. 111.

[6] Archæological Investigations of the James and Potomac Valleys, fig. 16, p. 56.

[7] Fort Ancient, p. 207.

Squier and Davis instance a unique curved-base pipe, upon the upper surface of the base of which are a number of small holes. Among mound pipes many are found the bowls of which are spool-shaped on a curved base.[1]

Fowke figures one from Williamsville, Virginia.[2] Squier and Davis also record a specimen from a mound on the east bank of the Scioto River, found in association with a thin copper plate.[3]

One of pipestone is recorded from Buffalo Township, Iowa, by Mr. S. Tiffany.[4]

The fact of these pipes being buried with human bodies has been thought to prove that they were invested with religious significance, though the same argument would equally apply to the many other objects found in aboriginal graves, which were the usual receptacles of the possessions of the dead—a custom by no means confined to America and applies to most countries with equal force. In mound No. 8 Squier and Davis found nearly 200 pipes, many of which "were much broken up, some of them calcined by the heat, which had been sufficiently strong to melt copper."[5]

The figures of some of these pipes of animal form appear to have had artificial eyes, most of which were destroyed by fire; a pearl, however, which formed the eye of one, yet remains.[6]

A similar occurrence is noted of a bird pipe made of pipe stone found in a mound at Toolsboro, Iowa, with pearl eyes.[7]

Pearls are found in some of the unios of the Mississippi. These pipes were originally supposed to be very hard and of a porphyritic character, but upon investigation were discovered to be either a siliceous clay slate, an argillaceous ironstone, a pearly brown ferruginous chlorite, calcareous marl, or marly limestone.[8]

In the collection of the American Museum of Natural History in New York City there are twelve or thirteen specimens and fragments of the Squier and Davis pipes from Mound City, Ohio. Mr. A. E. Douglass also has two very perfect ones of the Squier and Davis find. There is in these collections enough material to demonstrate that the technical work on these curved base pipes, which have caused so much wonder for the last forty years, is of a very superior order. The artistic skill of those making them is evidenced in every line of the pipes and of their ornamentation. The bowls have been perforated by means of hollow metal drill points and the small stem holes by solid points; the scales on the frogs and the feathers of the birds are cut with an accuracy and

[1] Ancient Monuments of the Mississippi Valley, p. 30.

[2] Archæological Investigations of the James and Potomac Valleys, p. 30, fig. 5.

[3] Ancient Monuments of the Mississippi Valley, p. 179, fig. 68.

[4] W. H. Pratt, Proceedings, Davenport Academy of Natural Sciences, I, p. 113, plate IV.

[5] Ancient Monuments of the Mississippi Valley, p. 152.

[6] Edward T. Stevens, Flint Chips, p. 425, fig. 48, London, 1870.

[7] W. H. Pratt, Proceedings, Davenport Academy of Natural Sciences, I, p. 108.

[8] Edward T. Stevens, Flint Chips, p. 414, London, 1870.

delicacy of detail in thin, sharp lines which appears to indicate the use of sharp-pointed tools. The head of an Indian, the bowl of which is drilled from the top of the head down by means of a thin tubular drill, the platform being broken off on both sides, is a well executed likeness of an American Indian, while certain incised lines upon his face are probably intended to represent the lines of paint or tattooing. These lines are cut in sharply and deeply, and it is an artistic production. A few of the surface lines of this pipe have first been incised and subsequently partially obliterated by grinding or polishing, but yet remains sufficiently clear to suggest the use of the steel file. The whole effect of this head is calculated to impress one who carefully examines it with the idea that it is the work of a skillful European carver.

One of these specimens in the Museum of Natural History is a curved base pipe having upon the convexity of the base an animal in a sitting or squatting position, but whether bear, wolf, dog, or mouse it would be impossible to say. The perforation for the eyes goes from side to side, and there can be little doubt it was intended to insert artificial eyes of some sort. A peculiarity of this specimen is that below the eyes there are two small holes bored, one on each side of the upper part of the face, that are so small, indeed, and sharply cut as to indicate the employment of a steel point as fine as a fine needle. A splinter of stone could not have made the hole, a point of native copper wire could scarcely do it, the small size and clear cutting being probably owing to an implement of European manufacture. There are four or five of what have been and are supposed to be file marks upon the top of the head of this animal directly between the ears, two of which lines, however, could not be made with the flat part of the file. There are two frog pipes of the mound type in the Douglass collection, one of which has eyes which protrude; the other has eyes bored through from side to side for the insertion of artificial objects. The scales of the frogs it would be possible to cut with a sharp stone point, but the fine lines look as though cut by sharp metal tools.

One of the pipes having an urn-shaped bowl and another representing an animal, possibly an otter or beaver, arising from the water, has a number of sharp file marks of regular length and equidistant, which it would be difficult if not impossible to imitate without steel tools.

The Douglass collection contains two of the original Squier and Davis find from Mound City, near Chillicothe, Ohio, one made apparently of an oolitic limestone, the other of a brownish stone of medium hardness, both representing birds. The bowls of these specimens have been bored, as the others appear to have been, by means of tubular drills, and the irregularity of shape of one of the bowls, the cross section of which somewhat resembles an irregular circle, was probably made with a loose drill point, which would not inconvenience one working with strap or pump drill, but would be extremely awkward to make with a shaft revolved on the thigh or between the palms of the hands.

"Four miles north of Chillicothe, Ohio, there lies, close to the Ohio River, an embankment of earth somewhat in the shape of a square with strongly rounded angles, and inclosing an area of 13 acres, over which twenty-three mounds are scattered without much regularity. This work has been called Mound City."[1]

Fig. 128.

MOUND SNAKE PIPE.

Mound City, Ohio.

Cast, Cat. No. 7231, U.S.N.M. Collected by Squier and Davis.

Squier and Davis say that the pipes found at Mound City "were intermixed with much ashes, pearl and shell beads, disks, tubes, etc., and a number of other ornaments of copper covered with silver."[2]

It were, indeed, difficult to conceive a more graceful design than fig. 128 represents. It is one of the casts of a pipe collected by Squier and Davis in Mound No. 8, at Mound City, Ohio. The cast is 3 inches long, the bowl having an interior diameter of three-fourths of an inch, the pipe standing 1$\frac{3}{8}$ inches in height. The snake is curled around the bowl with his tail extending along the base, the markings of the snake being represented by incised lines forming diamonds.

The Marquis de Nadaillac illustrates a pipe from a mound in Mercer County, Illinois, made from an indurated clay, on which the snake is wound three times around the bowl.[3]

Fig. 129.

MOUND FROG PIPE.

Mound City, Ohio.

Cast, Cat. No. 7230, U.S.N.M. Collected by Squier and Davis.

Another of the mound type of pipes is shown in fig. 129, collected by Squier and Davis in Mound No. 8, which in size varies little from the preceding specimen. The frog sits in typical position as though ready to jump, the legs being well shown, as are the toes of the feet, those in front being well turned in and three toes on each foot. The eyes were depressed; the scales, scarcely one-sixteenth of an inch in diameter, are formed by incised lines all over the body, having apparently been cut with a sharp-pointed tool. A somewhat similar frog pipe found in a mound with one which was plain is illustrated by Mr. R. J. Farquharson.[4]

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[1] Charles Rau, Archæological Collections of the Smithsonian Institution, p. 46.

[2] Ancient Monuments of the Mississippi Valley, pp. 151, 152.

[3] Les Pipes et le Tabac, Matériaux pour l'Histoire Primitire et Naturelle de l'Homme, p. 498, November, 1885.

[4] Proceedings, Davenport Academy of Natural Sciences, I, p. 119, plate IV, fig. 5.

Two frog pipes are referred to in the Great Bragge collection, one from Kentucky and the other from the Ohio River, of steatite and gray limestone, respectively,[1] either of which localities is well within the mound pipe area.

Fig. 130 is a cast of a catlinite mound pipe found on the banks of the Illinois River, near Naples, Illinois, described by Mr. J. G. Henderson. It represents the common hard-shelled turtle of the American rivers. The turtle is upon a short, round pedestal which rises from the curved base. In one of the eye holes there yet remains a copper bead representing the eyeball, the other being lost. The head is slightly extended from the shell; the tail is lying against the body, the feet being folded close to the body in front; the stem hole being one eighth of an inch, and that of the bowl one-half inch in diameter. This specimen is 3¼ inches, with a stem width of 1⅜ inches.

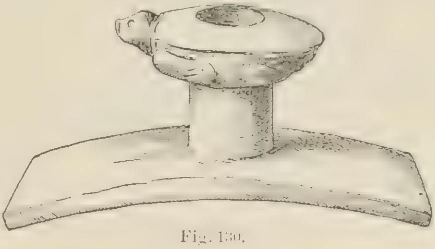

Fig. 130.

MOUND TURTLE PIPE.

Naples, Illinois.

Cast, Cat. No. 11609, U.S.N.M. Collected by J. G. Henderson.

Fig. 131, also one of the Squier and Davis Mound No. 8 pipes, is probably the best known of all this type. It is of about the same dimension as are the other pipes of this type and represents a typical Indian head. The eyes, nose, and mouth are well modeled and the ears are distinct. There is a knob on the top of the head and two back of the ears, the significance of which it is difficult to explain, unless it be to designate the hair tied up. This head sits well down on the base and faces the smoker, as is almost invariably the case in pipes of this type unless the stem has been broken, in which event use is made of the opposite end. In some few instances an exception to the rule is observed in figures of birds facing the side of the stem and in one instance an animal is represented as looking back over its shoulder. From top to bottom of the bases or platforms of these pipes is often less than one-fourth of an inch. To bore a one-eighth inch hole through this requires great care. This Indian-head pipe was found in the altar of the mound.[2]

Fig. 131.

MOUND INDIAN HEAD PIPE.

Mound City, Ohio.

Cast, Cat. No. 7212, U.S.N.M. Collected by Squier and Davis.

[1] Bibliotheca Nicotiana, p. 155, Birmingham, 1880.

[2] Squier and Davis, Ancient Monuments of the Mississippi Valley, fig. 145.

Two other pipes were also found by Squier and Davis representing human heads. Whether the cowl-like appearance of this head is intended to represent some head covering or the hair is difficult to determine.

The Indian is not usually represented with head covering, though subsequent to the arrival of the whites they did at times wear caps purchased from the Europeans, especially those Indians who came in contact with the French.

Fig. 132.
MOUND RACCOON PIPE.
Naples, Illinois.
Cast, Cat. No. 11610, U.S.N.M. Collected by J. G. Henderson.

Thomas Campanius Holm, referring to experiences in New Sweden about 1645, says: "While my father and grandfather lived among them some Swedish women had undertaken to make some small caps out of all kinds of old clothes, at the top of which they fixed a tassel of various colors, which they made of different colored rags, which they unraveled and mixed together. Those caps pleased the Indians extremely and they gave good prices for them in their money."[1]

Mr. J. G. Henderson has also figured a pipe from a mound near Naples, Illinois (fig. 132), which he believes represents a raccoon, the fore and hind legs of which are well carved. The nose is quite sharp, the tail lies flat and straight out along the base, the eyes are close together, and the beast appears to resemble in the cast a mouse quite as much as it does a raccoon, the position being more typical of that usually assumed by the mouse than it is of that of the raccoon, though it may be that Mr. Henderson is correct, for he says that in the original every feature of the animal is perfect, including the bars on the tail and face.[2] There is little doubt that animals and birds represented on these pipes are often impossible of identification. This pipe is said to be polished as smooth as glass and to be made of a very hard stone.

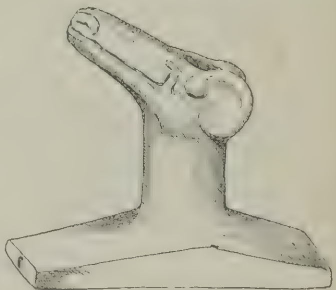

Fig. 133.
MOUND PIPE.
Mound City, Ohio.
Cast, Cat. No. 7216, U.S.N.M. Collected by Squier and Davis.

There are many other animal forms which have been found in these mound types, including the beaver, bear, panther, and lizard. Others, however, it can not be denied, are most difficult to determine. In one

[1] A short Description of the Province of New Sweden, now called by the English, Pennsylvania in America, p. 131, Philadelphia, 1834.

[2] Smithsonian Report, 1882, p. 689.

instance what is thought to resemble a groundhog may, with equal reason, be said to be a ground squirrel. A fox can not be distinguished from a wolf; and many animals represented upon pipes of this type have been declared by naturalists to resemble no well-defined genus with which they were acquainted.

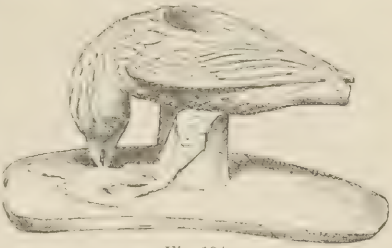

Fig. 134.

MOUND BIRD PIPE.

Mound City, Ohio.

Cast, Cat. No. 7232, U.S.N.M. Collected by Squier and Davis.

The original of a light gray cast in the U. S. National Museum (fig. 133) is of the mound type, and was also found in Mound No. 8. It is 3¼ inches long and 2⅝ inches high, with eyes carved in relief, the nostrils quite distinct, and the mouth represented by a long incised line. The curves back of the head may be intended to represent either ears or horns. This figure has been referred to as "a spirited head of the elk, though not minutely accurate."[1] Justice requires that we should say that this head resembles as much a sheep or horse as it does that of an elk or any of the deer family.

Fig. 135.

MOUND EAGLE PIPE.

Naples, Illinois.

Cast, Cat. No. 31478, U.S.N.M.

Collected by J. G. Henderson.

Dr. E. A. Barber has illustrated a somewhat similar pipe from Prairie du Chien, Wisconsin, which he suggests may possibly represent the mountain sheep or goat. In this case the animal faces from the smoker. This pipe is now in the Douglass collection,[2] and has had the front part of the stem broken. An inspection of the original suggests that the supposed horns are more likely intended for ears. Hon. Horace Beach, who collected the pipe, termed it "the dog pipe."

Fig. 134 is another of the Mound No. 8 specimens from Mound City, Ohio, and is 4⅛ inches long with height of 2 inches. The bird is evidently feeding, though it is impossible to say whether it is an eagle or crow. The feathers are carefully carved on the tail, wings, and body, and while it can not be said that the work could not be done with a stone point, it looks as though the tool used was a metal one.

The cast of an unusual pipe from a mound near Naples, Illinois, in Scott County, is shown in fig. 135, collected by Judge John G. Henderson, of Winchester, Illinois. According to Dr. Charles Rau, "it is the finest mound pipe thus far known." It doubtless represents a hawk or

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[1] Ancient Monuments of the Mississippi Valley, p. 257.

[2] American Naturalist, XVI, p. 279, fig. 19.

eagle; its great peculiarity being that the bird faces to the side rather than toward the smoker. It is said not to have been exposed to the heat of the fire, as so many mound pipes have. "A pipe shaped like an eagle, one of the real mound builder's bird-shaped pipes, was taken from the stone inclosure midway between Savannah and Fulton, Illinois. Its workmanship was perfect and its shape artistic to a high degree."[1]

The eagle and the hawk are both prominent among the totems of American Indians, and are frequently found on mound pipes, though it must be admitted that birds are more difficult to identify than animals. There were found in the mound near Naples, Illinois, along with the raccoon pipe and turtle pipe, objects of copper, "and a remarkable specimen which may be designated a sun symbol—a white stone, perfectly round, 12$\frac{2}{3}$ inches in diameter, about half an inch thick in the middle and 1 inch upon the edges, slightly concave upon one side and having upon the other a figure of a human hand."[2]

The mound pipe is usually found associated with copper implements. The file marks observable so often upon those parts of the surface which are most difficult to polish indicate the use of steel implements, and the presence of silver makes one suspect the influence of the white man. Judge Henderson's "perfectly round" disk is one of the strongest arguments in favor of European manufacture, for perfectly round disks do not appear to belong to aboriginal art of the northern continent, and when the delicate finish and artistic merit of the mound pipe is considered there is left the conviction that the European is the author of the type.

In many museums are found objects of bone made by the Eastern Eskimo, many of them carved and etched with great skill; but, as has been noted by Prof. Otis T. Mason, all fine etching on bone or ivory, such as the work of these Eskimo, is in proportion to their contact with Europeans. From the older graves there has been revealed no etching, and the carvings he finds are rude in proportion to their removal from the white man's influence.

The Davenport Academy of Natural Sciences has two pipes said to have been found in a mound in Muscatine County, Iowa, by some Germans, one of which represents a bear and the other an elephant. Both are said to be out of proportion,[3] as one is too tall and the other too slender. There is a second elephant pipe possessed by the Davenport Academy, from Louisa County, which was found in a mound in 1888.[4]

An illustration of one of the pipes is given after a photograph (fig. 136). In both pipes the tail is said to be well developed. There was a criticism of the animal carvings from the mounds of the Mississippi

[1] James Shaw, The Mound Builders in the Rock River Valley (Illinois), Smithsonian Report, 1877, p. 256.

[2] Smithsonian Report, 1882, p. 694.

[3] Proceedings, Davenport Academy of Natural Sciences, II, p. 348, figs. 22, 23.

[4] Idem, IV, p. 271, fig. 2.

Valley, by Mr. Henry W. Henshaw, from the standpoint of the naturalist, based chiefly on the famous Squier and Davis collection, in which he sums up his conclusions under four different heads as follows:

First. That among the carvings from the mounds which can be identified, there are no representations of birds or animals not indigenous to the Mississippi Valley, and consequently that the theories of origin for the mound builders suggested by the presence in the mounds of carvings of supposed foreign animals are without basis.

Second. That a large majority of the carvings, instead of being, as assumed, exact likenesses from nature, possess in reality only the most general resemblance to the birds and animals of the region which they were doubtless intended to represent.

Third. That there is no reason for believing that the masks and sculptures of human faces are more correct likenesses than are the animal carvings.

Fourth. That the state of art culture reached by the mound builders, as illustrated by their carvings, has been greatly overestimated.[1]

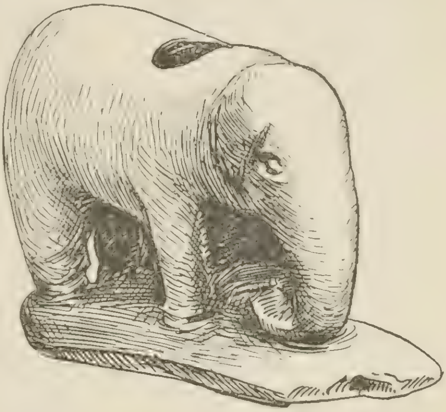

Fig. 136.

MOUND ELEPHANT PIPE.

After a photograph. Original in collection of the Davenport Academy of Natural Sciences.

These views can hardly be successfully combated by anyone at all familiar with the illustrations of the mound pipes unless it be contended that the illustrations themselves are defective. The casts of these famous pipes, a complete set of which is in the U. S. National Museum, suggest that the illustrations have done full justice to the objects represented. Mr. Henshaw in his criticism questioning the genuineness of the elephant pipes appears to have fallen into error in saying that the tails are absent in each of these pipes, and his reference from a naturalist's standpoint naturally ignores the technological consideration of the subject, as well as the contemporaneity of metal in the mounds, especially copper, and also the many asserted discoveries of objects of undeniably European manufacture, such as an implement of copper being found in the same mound with one of these elephant pipes. All of which are of course important bits of evidence in any summary going to make up a verdict as to the artistic ability of those who made the pipes.

While concurring entirely with Henshaw's summary, under the four heads, and while considering the same conclusively proven in favor of

[1] Animal Carvings from the Mounds of the Mississippi Valley, Second Annual Report of the Bureau of Ethnology, p. 166.

his contention, the writer, with due deference to the opinions of the many who may disagree with his conclusions, would add: That the age of copper implements and their use by the American Indians does not appear to have been sufficiently studied to demonstrate to what extent they had been employed prior to the advent of the whites, nor for how long. The tool marks on objects and technology generally of the mound builders appears to have been little considered; the finding of worked silver in mound No. 8, and a silver cross either in this mound or in one near it, as recorded by Squier and Davis, and the finding so commonly in remains of the mound period objects of European manufacture, all raise the suspicion, almost amounting to conviction, that the pipes were contemporaneous with the early whites, probably the French. The two elephants suggest, of course, an acquaintance with the animal, and unless the Indian can be shown to have known the beast before the European invasion, which with our present evidence seems improbable, the natural inference would be that this knowledge came from the whites, who we do know were well acquainted with the elephant, and as a consequence that the pipes were made after the European invasion of the country. The criticism of Henshaw caused quite a discussion in the archæologic world, though the fact remains that "the artistic merits of the mound builder's pipes have in some cases been overrated."[1]

Dr. Wilson, although suggesting this view, contends "that the objects wrought by their artistic skill reveal no less certainly their familiarity with animals of southern and even tropical latitudes, and the materials employed in their manufacture include mica of the Alleghenies, obsidian of Mexico, and jade and porphyry, derived probably from the same region or from others still farther south."[2]

These views will, however, meet with little agreement in America, for there appears absolutely no proof of any southern influences affecting the work on the American mound-builders' pipes.

While in many instances it appears impossible to say exactly what was intended to be designed other than man, bird, or beast, it can not be denied that among the mound pipes there are many forms of life skillfully delineated and with true artistic merit.

Some of these pipes are so carefully ground and their surfaces are so skillfully polished as to preclude the possibility of demonstrating the exact mechanical process employed in working them into shape, though parts of the work of finishing can at times be determined in a measure. The bowls of mound pipes have been bored usually with tubular metal drills, though there are examples bored with solid point. The uniform size of the bowls suggest that if bored by Indian tools, it was done with the solid shaft revolved between the hands. There are exceptions known in which the bowl has an irregular shape, owing to a loose point on the drill shaft, which would suggest its being caused by the employ-

[1] Daniel Wilson, Prehistoric Man, I, p. 366, London, 1876.

[2] Idem, I, p. 363.

ment of a strap or pump drill, tools apparently unknown until the whites came into the country.

The pipes in shape of the human head are remarkably well executed: the snake is not to be mistaken, nor the frog, nor the beaver; members of the cat tribe appear to be represented, and the turtle; though of these the species is often indeterminate. Birds are usually distinguishable only as birds; scarcely a single one can be positively recognized as to species. Elephant pipes are as good representations of the animal as are those of any other creature of which examples have been found. The artistic ability to imitate in stone animal form and action is no more developed in pipes of the mound-builder type than it is in stone carvings made by Indians in contact with the white man of the present day, the latter producing work equal, if not superior, to any from the mounds. An argument in favor of the contemporaneity of these pipes with the whites is that were they of purely aboriginal origin we would find also numerous examples of their idols or fetishes, executed with similar artistic ability. If these objects were of local white origin, we may safely infer that while the whites would supply pipes in effigy of man or beast, the religious prejudices both of early French and English during the seventeenth century would have caused either to recoil with horror from any attempt to further idolatry or idolatrous worship for fear of their own future punishment did they do so. Mr. William Wallace Tooker, says: "The discovery of the monitor pipe among the effigies of Wisconsin, with curved base, a round bowl, and the same finish as those found in the mounds of Ohio, I regard as an additional link in the chain of evidence that they are of Algonquin manufacture wherever found. Here I regret to differ with Prof. Cyrus Thomas, who attributes this form of pipe to the Cherokees."[1]

An examination of the geographical distribution of mound pipes apparently sustains Mr. Tooker's assertion that they are not of Cherokee origin, though he appears to consider the monitor and mound pipe as identical, which to the writer they do not appear to be. The hollow of both bowl and stem in the platform or monitor pipe is usually larger than in the mound pipe. The former always has a flat base, while the latter is curved. The monitor seldom, if ever, has any ornamentation upon it in the way of figures of animals; the latter commonly has. The monitor does not appear often west of Ohio. The mound pipe is as often found in Illinois, Iowa, and Michigan, as in Ohio. The monitor is found in Tennessee, North Carolina, and South Carolina, and in the northern United States. The mound pipe is not found in the States bordering on the Atlantic. The monitor is made from a soft stone and the mound pipe from a much harder one. General Gates P. Thruston considers, after careful examination of some of the originals and of casts of the Squier and Davis collection, that as types of the mound-

[1] The Bocootawananukes, or the Fire Nation, The Archæologist, August, 1895, p. 255.

builders' art the fine Tennessee and southern pipes are not inferior to the Ohio mound pipes.[1]

The geographical distribution of mound pipes indicates two centers, one near Chillicothe, Ohio; the other near Davenport, Iowa, with some in Illinois and few in Indiana, about Laporte, near the lower edge of Lake Michigan.

Colden's Five Nations (1747) indicates the existence of certain great carries, then well known, between the headwaters of the Hudson and Lake Champlain; Lake Erie and the headwaters of the Allegheny; another from Lake Erie, by way of the Maumee, to the Wabash; another from the Maumee to the headwaters of the St. Joseph and then into Lake Michigan. The absence of mound pipes, or their scarcity, even in Illinois and Indiana is merely negative testimony, but taking the extremes of Chillicothe and Davenport, what would be the easiest route from the former to the latter? To float down the Scioto to the Ohio and down the Ohio to and up the Mississippi to Davenport, Iowa, would take one through a country where this pipe is not found, or so rarely found as to negative the likelihood of this being the direction of travel. This route would also be through a country where one would, during the seventeenth century, more probably have encountered antagonistic linguistic stocks than would have been the case had the route up the Scioto, across to the head of the Maumee, from the Maumee across to the St. Joseph been followed down to Lake Michigan, and from the lake either by way of Green Bay to the Wisconsin, and down it or by crossing the carry in the neighborhood of Chicago, and down the Fox River into the Illinois, or to strike the Rock River and down it to the Mississippi. This northern route and then westward, followed by any of the waters indicated, would carry one through affiliated tribes at the early period of our history, and throughout this indicated territory the mound pipe appears common. Again, if the mound pipes owe their origin in anyway to white influences, the territory through which they are found is within the area first reached by the French, who spread over the interior waters, by way of the lakes, as a base from which the St. Lawrence could be most easily reached. Admitting French influences as affecting the style of the mound pipe, their not being found along the shores of Erie and Ontario or on the St. Lawrence would indicate strongly that the foreign influence was one indigenous to the interior, which is easily explainable upon the theory that it was a supply made to meet a local demand. Were the mound pipes of great age it is not likely that specimens would be found of catlinite, from which some were made, if we may rely upon the records. The vast distance from which it had to be brought, from the country of a people of distinct linguistic stock, would also indicate no great antiquity to its use, but the material, we know, after the advent of the whites, became an article of barter, chiefly, the writer believes, due to the spread of general trade with the natives.

[1] Antiquities of Tennessee, p. 177 note, Cincinnati, 1890.

The specimens of pipes in the collection of the U. S. National Museum of the mound type have usually plain bowls, and there is absolutely no reason to suppose them to be other than they are represented. They have been examined closely for surface indications of tool marks, which were found in most instances, and suggest the presence of the metal file of the whites. Their geographical distribution would also suggest Lake Michigan or Erie as being the point of origin of the type rather than either of the extremes of Chillicothe or Davenport. The similarity of the type is undoubtedly due to a common origin for the Iowa and Ohio pipes, though the curved base of Ohio appears to have a tendency to flatten along the Mississippi bank of the State of Iowa, though it would be natural to suppose the flat base more ancient and more readily made than the curved. The localities where these pipes are usually found corresponds with the route which Marquette and other French travelers appear to have followed down to the Mississippi and into Ohio from Lake Erie, which is presumably the route well known to the fur traders who preceded the discoverers. The style of the carving on these pipes is certainly more of a civilized than of a savage character, and undoubtedly belongs to a much higher art than other primitive and ancient objects found on the North American continent, and does not correspond with what is known of the product of the Indians' primitive tools. The writer is informed by Mr. David Boyle, an authority on the archæology of Ontario, in answer to a question as to whether the mound type of pipe had been found in Ontario or on the St. Lawrence, that, "indeed it would not surprise me to find a few stray pipes of this kind in Ontario, but nothing of the sort has come to my notice. If French influence was in any way connected with the curved base, nothing is more reasonable than that numerous examples of it should be met with in this country, but, while I am not in a position to state positively, I have never even heard of one. I think that the fact of curved base pipes being found always on the line of French travel is merely a coincidence and a very natural one. Those who affected this style of pipe along the valleys of the Scioto, the Wabash, the Illinois, and the Wisconsin were the people among whom the *voyageur* and the *coureaur du bois* met with most success in their trading operations, and the following of the river routes was as natural to the Frenchman as to the Indian. That many pipes are the product of European skill is, I think, undoubted, but I sometimes think also there is a tendency to attribute too much to this source. It is undoubted that there is a tendency to modernize the Indian and his manufactures, though, on the other hand, those favoring his great

Fig. 137.
STRAIGHT-BASE MOUND PIPE.
Clifton, Kanawha County, West Virginia.
Cat. No. 3217, U.S.N.M. Collected by P. W. Norris.

antiquity have for so long held the field that to raise the question will only open the door to impartial examination and final successful determination after a thorough investigation of all the proofs."

Fig. 137 is a straight-based white limestone pipe of the mound type, collected by Mr. P. W. Norris. Though the bowl is very plain and the base extends only on one side of it, the stem opening of this pipe is three-eighths of an inch and that of the bowl about 1 inch, which marks this specimen as quite unusual for this type in its stem, from the large opening. It was found at Clifton, Kanawha County, West Virginia, and is very much weathered and as soft, almost, as chalk. Another specimen of this type, having an unusually large stem, is in the Douglass collection, which was found in Highland County, Ohio, being made of a light gray stone. Yet another, apparently related to these two, having a stem opening of three-eighths of an inch, is in the same collection and is from Putnam County, West Virginia.

DOUBLE CONOIDAL PIPES.

There is yet another and markedly distinct type of pipe which is found distributed over a wide, though contiguous, area, which invites most careful scrutiny, whether from a technological, archæological, or ethnological standpoint. The characteristics entitling it to be classed as of like type are, that the bowl and stem holes consist of conoidal excavations made at right angles to each other, meeting at their apices where the two cavities intersect. This type, in its exterior form, varies greatly, in fact more than probably any other American type known, yet the stem and bowl are so true to type as to stamp a kinship which is difficult to ignore. Did we alone consider merely the biconical perforations, in the majority of instances it would be impossible to say which was intended to hold the stem and which the tobacco, and it must further be admitted that in the whole number of pipes of this type in the collection of the U. S. National Museum there is not a single specimen which has upon it, so far as the writer could observe, a mark indicative of the use of other than the stone tool of the primitive Indian, though many of this type are of quite elaborate design. Certain similar art concepts are observable in this type within restricted areas and it will be interesting to determine whether they are due to tribal, totemic, or trade influences. The materials of which these pipes are made are as varied as the pipes themselves. They are found of pottery, indurated clay, steatite, and even sandstone. The pottery of some is

Fig. 138.
DOUBLE CONOIDAL PIPE.
McNairy County, Tennessee.
Cat. No. 97430, U.S.N.M. Collected by W. M. Clark.

pure clay; of others the clay is mixed with a shell or sand tempering. Some of the material is most suitable, other is most unsuitable, to resist heat. Some of these pipes are found made of the most primitive form and others of the most ornate, showing an artistic conception and excellence of treatment quite remarkable.

Fig. 138, collected by Mr. W. M. Clark, from McNairy County, Tennessee, is an almost perfectly square block of reddish sandstone, about 3 inches in exterior diameter, which has been hammered or picked into shape without the slightest effort to smooth its surfaces, its stem and bowl cavities each being cone-shaped and about half an inch in diameter at the surface with a like depth, and are at right angles to each other, intersecting at the apices of the inverted cones where the opening between the bowl and stem is scarcely one-fourth of an inch in diameter. There is no evidence in this specimen of any tool being used, even in excavating the bowl and stem, except a picking implement. The chief distinction between this pipe and the ordinary bowl pipe is that in the latter the stem opening is seldom in excess of one-half the diameter of the opening of the bowl and is generally much less, though it must be admitted that this difference could be reconciled were it owing to difference in supply of stem material.

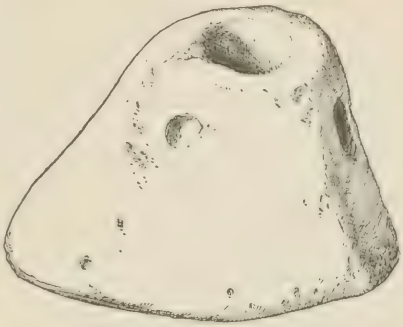

Fig. 139.
DOUBLE CONOIDAL PIPE.
Ohio.
Cat. No. 6708, U.S.N.M. Collected by J. H. Devereux.

Another pipe, belonging apparently to this type (fig. 139), is from Ohio, collected by Mr. J. H. Devereux. It stands about 4 inches high, and is made of a water-washed pebble of gray sandstone, upon which almost the only artificial work has been performed in excavating the bowl and stem openings and in making shallow depressions on each side, as though to indicate the eyes of some creature. In outline this stone is unattractive, and were it not for the eyes would be scarcely more remarkable than the first figure of this type. A striking and somewhat typical characteristic of this pipe appears on its base, which has been flat, but is worn in its longer diameter into quite a broad, deep groove, evidently caused by being used as a grindstone for sharpening tools. Upon the back of this pipe the stone has been slightly ground above and below the stem hole. There is in the collection of the museum of the University of Pennsylvania a similar specimen from West Virginia, made of brown stone, having a bowl $1\frac{5}{8}$ inches in exterior diameter. The diameter of the stem is large, but its dimensions can not be given because of the scaling of the stone. Around one part of the side of the stem opening where it is not scaled two rings are cut in intaglio,

one larger than the other; eyes are also incised. Across the front of this stone are incised a number of straight lines, one above the other, the significance of which it is difficult to guess. Except as noted, the stone presents only a water-washed appearance, saving that on the bottom appears again the long, deeply worn groove made by sharpening tools, which is cut deep into the stone. This peculiarity in the natural shape of the pebble appears to have been suggestive to the Indian mind of the form of an animal, which he has endeavored to perfect by cutting a few lines across the stone. A specimen of this type (fig. 140), found by Mr. Warren K. Moorehead in Ohio, though badly broken, shows how the Indian has taken advantage of the peculiar shape of a water-washed pebble to make a pipe. The material is a sandstone, which one would suppose was poorly suited to resist the heat generated in smoking it. Yet here was a shape suggestive of animal form which would cause a child or even a grown person to preserve it, which, with the slightest addition, would give the most primitive representation of animal form which we have met with. There are few archæologists who have not at some time been astonished to find water-washed pebbles or concretions of unusual shapes on the sites of Indian villages which had evidently been collected and preserved by the Indian because of their resemblance to some creature or object. All experience has a tendency to impress the archæologist with the fact that man in a savage state had quite a lively appreciation of grace of outline in stones or shells, as well as that he would be impressed with brilliance of color, whether it were in the plumage of birds, the tint of shells, or the brilliance of foliage.

Fig. 140.

DOUBLE CONICAL PIPE.

Ohio.

After specimen in possession of Warren K. Moorehead.

Fig. 141.

DOUBLE CONICAL PIPE.

Louisiana.

Cat. No. 8641, U.S.N.M. Collected by D. Swift.

An unattractive and unornamental pipe of rectangular shape (fig. 141), collected by Brig. Gen. D. Swift, of the United States Army, from Louisiana, having the upper part of its bowl broken, but with peculiarities entitling it to be classed in this type, is of sandstone and has the groove for tool sharpening on its base, in addition to the similarity in diameter of bowl and stem opening. Upon one corner of the base there is a drill hole, which has been begun and is an eighth of an inch wide with a depth of about three-

sixteenths of an inch, two similar depressions being on the front of the pipe.

Another rectangular, double conical pipe (fig. 142), found in a mound in Louisiana, collected by Brig. Gen. D. Swift, United States Army, is of soft white sandstone, about 3 inches long, with an equal height, and a width of 2 inches. It is, however, badly broken and worn, and though upon one side there is a scroll-work design which extends around the front, upon the other side the erosion of time has eaten away all signs of ornamentation. The sigmoidal curves are gracefully executed, and though the stem is slightly deeper than is the bowl, each has been bored by means of broad-pointed drills, preserving the biconical characteristic of the type. There are two bands around this bowl—one plain and the other gracefully curved, with semicurved lines from the interior edge of the bowl to the plain band, which gives the appearance of a rope encircling the upper edge of the bowl.

Fig. 142.
DOUBLE CONICAL PIPE.
Louisiana.
Cat. No. 8642, U.S.N.M. Collected by D. Swift.

This type is apparently the same, in fig. 143, from southeastern Missouri, collected by Mr. F. S. Earle, which is slightly larger than the last figure and is made of a compact, fine-grained sandstone. The decoration of this pipe, the shape of bowl and stem—in fact, the entire pipe—are suggestive of a knowledge of pottery. The base is massive in proportion to the size of the rest of the pipe, and is suggestive of similar characteristics in pipes of this class. The stem shows a somewhat greater elongation than does the bowl, though the biconical bowl and stem are little changed. Six crosses surround the bowl, which are of so pronounced a Greek type as to suggest the white man's presence; and although many archæologists instance supposed pre-Columbian occurrences of the cross, it must be suggested that the occurrence of several crosses together raise more strongly the suspicion of the presence of the European than would a single cross, especially throughout the territory where Spanish and French influences were first felt. The pioneers of these regions were often members of religious orders, whom all early accounts record were

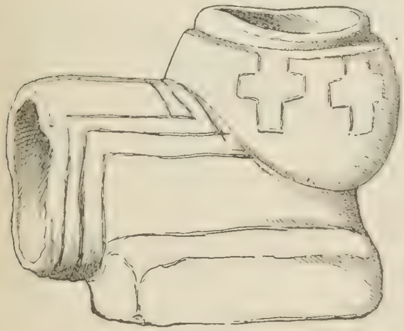

Fig. 143.
DOUBLE CONICAL PIPE.
Southeastern Missouri.
Cat. No. 72134, U.S.N.M. Collected by F. S. Earle.

the first to raise the cross upon entering every Indian village. The French constantly refer to this practice, as do the Spanish, notably Castaneda, chronicler of the expedition of Alarcon, as well as the early missionaries of the Mississippi River.[1]

Fig. 144 is distinctly of the same type and differs from the three preceding specimens only in that it is made of a gray serpentine. The specimen is 4 inches long, 3 inches high, and 1¾ inches wide, the biconical characteristics of bowl and stem being of proper corresponding dimensions. It was found in Mobile Bay, being collected by Mr. C. Caderte. The elongated stemmed specimens of this type appear to have been scraped into shape and finally ground to a uniform surface. There is in the U. S. National Museum a specimen (Cat. No. 59279) of chloritic slate which has been shaped by first sawing out the form, which subsequently was scraped and ground to a uniform surface. Similar work is evidenced in modern unfinished stone pipes from California and Oregon in the U. S. National Museum. This process by which they were finished corresponds with stonework noticed on implements found in Swiss lake dwellings of the stone period. The work upon any given implement would naturally depend upon the hardness of the particular material. On certain of the biconical pipes the bowl and stem cavities appear to have been first started by pecking a depression into the surface. This would be enlarged by a solid drill or at times even finished with the drill, though there are specimens which have had the cavities enlarged by gouging, a very common practice with all pipes of soft stone.

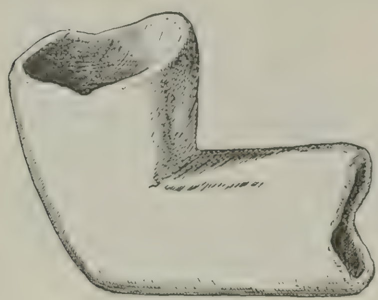

Fig. 144.
DOUBLE CONICAL PIPE.
Mobile Bay, Alabama.
Cat. No. 32324, U.S.N.M. Collected by C. Caderte.

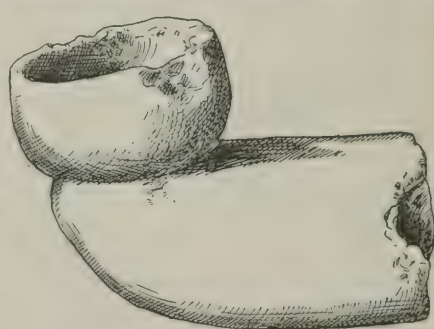

Fig. 145.
DOUBLE CONICAL PIPE.
Georgia.
Cat. No. 131980, U.S.N.M. Collected by J. McGlashan.

A careful study of American stone implements, or those, in fact, of the stone age elsewhere, demonstrates, with scarcely an exception, that primitive man shaped stone tools with the least possible labor. Few implements of the stone period required so long as a week to make

[1] Castaneda, 1540, Relation du Voyage de Cibola, translated by H. Ternaux Compans, pp. 272, 292, 310, Paris, 1835.

them, and in the majority of instances scarcely more work was put upon them than could with stone tools be done between the rising and setting of a day's sun. Arrow and spear heads require but comparatively few minutes from the beginning of work upon the spall to their completion with the chipper.

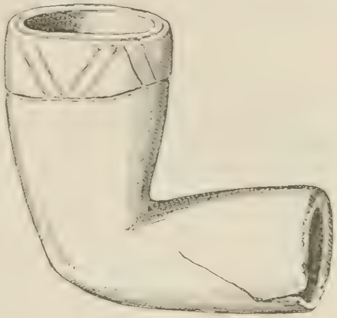

Fig. 146.
BICONICAL PIPE.
Wood County, Virginia.
Cat. No. 2366, U.S.N.M. Collected by D. N. Neal.

Fig. 145, from Georgia, collected by Mr. J. McGlashan, is made of a soft steatite, which has a stem of ellipsoidal shape, though its bowl is similar in shape to that of the pipe figured from southeastern Missouri (fig. 143), and retains the biconical characteristics in bowl and stem openings, both of which have been gouged out with a chisel, the pipe being $3\frac{1}{2}$ inches long.

A fine-grained, compact brownstone pipe (fig. 146) from Wood County, Virginia, collected by Mr. D. N. Neal, $3\frac{3}{4}$ inches high and of similar length, with round bowl, and stem has a simple ornamentation, though the shape of the pipe indicates that similar ones were made of pottery. The stem hole of this pipe is slightly smaller than that of the bowl, both being drilled, however, with a solid point.

Fig. 147 is a light-colored pottery pipe from Osceola, Arkansas, collected by Dr. Frank L. James. It is but slightly burned, and appears to contain no tempering material. The characteristics of bowl and stem appear to belong to the biconical type, though the point or prow beyond the bowl is a marked characteristic of the Siouan pipe, as well as those of some of the other Western Indians.

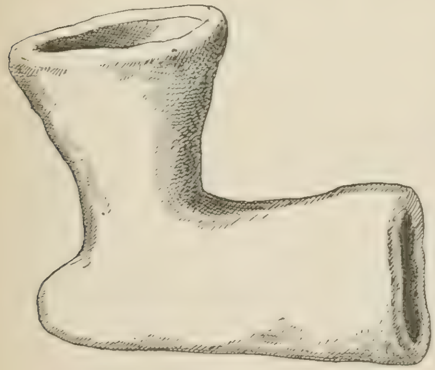

Fig. 147.
BICONICAL PIPE.
Osceola, Arkansas.
Cat. No. 31134, U.S.N.M. Collected by Frank L. James.

Mr. Clarence B. Moore, in his monograph, figures a number of pipes which appear to belong to the type under discussion, and are in the geographical area where similar pipes are found,[1] though Florida produces apparently also the large-bowl pipe, which has a small stem.

Two hard-burned, nearly black, double-coned pipes, with flat bases,

[1] Certain Sand Mounds of the St. Johns River, Florida, Pt. 2, pp. 154, 185, figs. 21, 60, Philadelphia, 1894.

from a stone grave in southeastern Missouri, are in the museum of the University of Pennsylvania, which also possesses a light clay pipe of this type, upon the surface of which are a number of circular stamped impressions in the clay. There is also in the same museum a partly decorated pipe of this type from Kershaw, South Carolina, made of a light-yellow pottery, and yet another made of steatite found on the site of an Indian town in a grave 2 feet below the surface near Camden, South Carolina, which has a double row of ornamental figures running around stem and bowl. These last two pipes have been illustrated by Schoolcraft.[1]

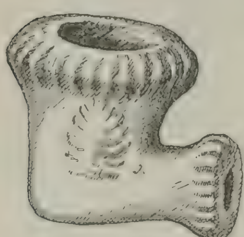

Fig. 148.

MODERN POTTERY MOUND PIPE.

St. Johns River, Florida.

Cat. No. 2420, U.S.N.M. Collected by G. S. Taylor.

A unique specimen of a pottery pipe (fig. 148) is from St. Johns River, Florida, and was collected by Col. G. S. Taylor. It is only an inch high, with a like length, and was found in a mound, though there can be no doubt of its modern origin, as it yet retains the mold mark and stamp of a tobacco plant and the coat of arms of the pipe makers' guild of London, though the type does not appear to be that of any of the many early known ones turned out by English pipe makers, being the only specimen which has come to the writer's notice.

In fig. 149 is again encountered the projection common in the territory contiguous to the Sioux. It is a pottery pipe, the clay from which it is made having a mixture of shells. It is from Indian Bay, Lonoke County, Arkansas. It is about 3 inches long and of like height, the band around the bowl being decidedly ornamental. The size of bowl and stem retain the characteristically large dimensions of the biconical pipe cavities. There is in the U. S. National Museum collection a light-colored clay pipe of this type from Pecan Point, Mississippi County, Arkansas, the bowl of which has been badly broken, though enough remains to show that a snake was twined around it, the head being yet intact. The stem of this pipe is elliptical and the point less pronounced in front of the bowl than in any of the pipes figured.

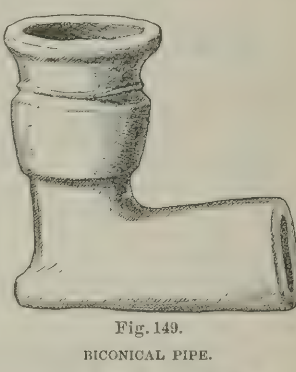

Fig. 149.

BICONICAL PIPE.

Indian Bay, Lonoke County, Arkansas.

Cat. No. 88123, U.S.N.M. Collected by E. Palmer.

While retaining bowl and stem characteristics, fig. 150 is a hard-burned pottery specimen from Carroll County, Tennessee, collected by Rev. E. H. Randall. It presents quite a peculiar feature in the band or

[1] North American Indian Tribes, Pt. 2, plate 43.

handle reaching from the end of the stem to the top of the bowl, a somewhat similar characteristic appearing on the pipe from Tennessee (fig. 207), in which the hair or cue forms a somewhat similar ornamentation. This band is possibly intended for the double purpose of attaching the cord to the stem and as an ornament. It is decidedly shorter, however, than others of these pipes upon which the Siouan prow appears. A somewhat similar pipe, though of stone, from Hickman County, Kentucky, is figured by Dr. Joseph Jones, the handle of which he thinks is in imitation of the armadillo.[1]

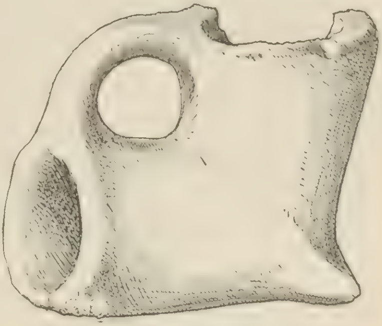

Fig. 150.
BICONICAL POTTERY PIPE.
Carroll County, Tennessee.
Cat. No. 34522, U.S.N.M. Collected by E. H. Randall.

A pottery pipe (fig. 151) from Loudon County, Tennessee, collected by Mr. J. W. Emmert, has a bowl apparently formed in shape of those of the biconical type, though its stem belongs rather to a class of pipes found commonly in North Carolina, South Carolina, Georgia, and Tennessee, many of which are of metal, while others are of stone made in imitation of metal or pottery forms. The pottery of which this specimen is made has a large percentage of shell mixed with the clay.

Are these pipes of Cherokee type, concerning which it has been said "they (the Cherokees) smoked sumac leaves in wooden pipes, the tube of which was made of cane. I have seen such pipes belonging to them which were in the shape of a bear—the opening for the tobacco on the back and the tube fixed near the tail,"[2] or does the author refer to those heavy pipes of biconical form in imitation of animals? Thruston has called attention to this type, saying: "Large funnel-shaped stem holes, sometimes even larger than the pipe bowls, appear to the author to have been one of the distinguishing characteristics of the southern clay and stone pipes, and we suggest to antiquarians the importance of this feature in the proper classification of these objects."[3]

Fig. 151.
POTTERY PIPE.
Loudon County, Tennessee.
Cat. No. 116026, U.S.N.M. Collected by J. W. Emmert.

This feature of bowl and stem is a peculiarity extending over an extensive and continuous geographical area from Florida, South Caro-

[1] Explorations of the Aboriginal Remains of Tennessee, p. 138, fig. 74.
[2] Maximilian's Travels in the Interior of North America, p. 81, London, 1843.
[3] Gates P. Thruston, Antiquities of Tennessee, p. 178, Cincinnati, 1890.

lina, Georgia, and Alabama, over to and down the Mississippi River, and up the same as far as Michigan, generally upon the eastern side of the great river, through a territory familiar to the French from 1680 onward for nearly a century. Animal forms are quite common in this type, those of the human being probably predominating; some appear to be totemic, while the artistic merits of many are of a character difficult to reconcile with savage art. These pipes are at times so massive as almost to justify the term monumental in referring to them, a remarkable peculiarity being that, with scarcely an exception, the creature faces from instead of toward the smoker, as is common with the mound pipes and the older catlinite rectangular specimens. They vary from 3 to 8 inches in length or height, and from 2 to 4 inches in width. Among the animal forms none is more common than the frog.

Fig. 152.
BICONICAL FROG PIPE OF SANDSTONE.
Branch County, Michigan.
Cat. No. 42931, U.S.N.M. Collected by H. T. Woodman.

A pipe of the biconical type from Algansee, Branch County, Michigan, collected by H. T. Woodman (fig. 152) is about 4 inches long and almost as wide, and is 2½ inches high. The legs and eyes are represented in low relief, the bowl and stem holes are both pecked in, and each has a surface diameter of 1¼ inches. The pipe is made from a compact and hard, close-grained sandstone, shaped by means of a stone hammer, and though the surface has been subsequently smoothed the hammer marks in places are quite distinct.

Fig. 153.
BICONICAL FROG PIPE.
Cherokee Nation.
Cat. No. 7331, U.S.N.M. Collected by J. A. Paxton.

In fig. 153 is shown a pipe from the Cherokee Nation, collected by Mr. J. A. Paxton. The frog has been carved somewhat more in the round, the texture of the stone appearing so like the last figure as to raise a suspicion that both came from the same locality. The stem hole of this pipe is scarcely half an inch in depth, and that of the bowl hardly over seven-eighths of an inch deep, the stem being smaller than the bowl opening, the shallowness of the same making it extremely difficult to attach a pipestem. The base of this pipe has the same

worn groove noted in some of the ruder pipes of the type, caused by rubbing some object back and forth as though to give it a point, the cavity being worn in quite half an inch at its greatest depth.

Similar to the two preceding specimens is fig. 154, a cast from Miami County, Ohio, collected by Dr. E. H. Davis, the original being of brown stone. It is carved with greater skill than either of the other specimens, is 5 inches long, with a corresponding height, and has a width of 3½ inches. The hind legs are more in relief than in the other specimens, the fore legs being carved entirely in the round. The eyes of this frog are represented by depressions, but in other respects there is great similarity of treatment of all three figures.

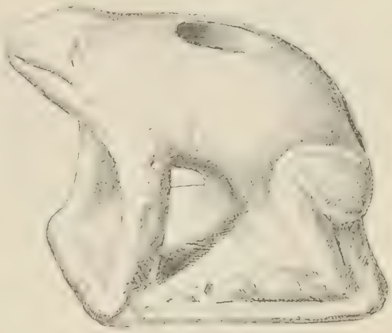

Fig. 154.

BICONICAL FROG PIPE.

Miami County, Ohio.

Cast, Cat. No. 7206, U.S.N.M. Collected by E. H. Davis.

The characteristics of the biconical type are preserved in fig. 155, a pottery pipe from Nelson County, Virginia, collected by Mr. J. Ralls Abell. The specimen is 4 inches long, 3½ inches wide, and 2½ inches high, made from a clay mixed with shells, though it is quite indifferently burned. The hind legs are molded in high relief, the fore legs being brought together under the chin. The eyes are quite prominently raised above the surface. Into the pottery a number of rings have been cut after the pipe was baked.

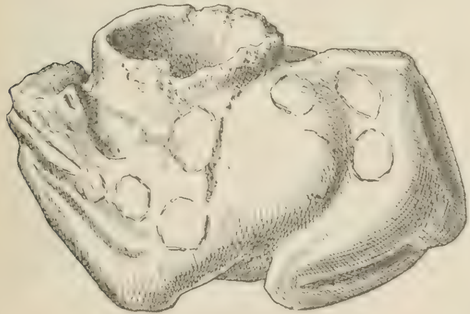

Fig. 155.

BICONICAL POTTERY FROG PIPE.

Nelson County, Virginia.

Cat. No. 11596, U.S.N.M. Collected by J. Ralls Abell.

A light-colored pottery pipe (fig. 156) from a mound in Coahama County, Mississippi, collected by Hon. J. L. Alcorn, represents some quadruped, though it would require a vivid imagination to be more specific and say for what it was intended. The pipe is 5 inches long, 3 inches wide, and 3½ inches high, and represents the creature as about to hop or jump away. Into the face the eyes have been cut, and both above and below them are three straight cross lines parallel to each other. From the side of the head or jaw there are wing-like extensions upon which eight or nine parallel lines are cut into the pottery ware. On the top of the head are two knobs on each side, as though intended to indicate horns and ears. The fore legs are rudely modeled in the

round. The upper edge of the bowl, which is 1¼ inches in diameter, is slightly raised above the surrounding surface, and instead of one there are two stem holes connecting with the bowl, each of which is about the same diameter as is the bowl. The double stem or double bowl is a feature, though not a common one, in American pipes. The clay from which this pipe was made does not appear to have either shells or sand tempering.

Fig. 156.
BICONICAL ANIMAL PIPE.
Coahama County, Mississippi.
Cat. No. 11649, U.S.N.M. Collected by J. L. Alcorn.

Fig. 157 is a soft, coarse, gray sandstone pipe from a mound in Louisiana, collected by Brig. Gen. D. Swift, United States Army, and stands 3 inches high and represents some four-footed creature; this pipe, however, has not been completed, for neither eyes, nose, nor mouth are indicated. The legs are represented in the manner at times observed in toys, or as they appear upon certain of the statues found by Layard at Koyounjik. The slightly raised bowl has the same treatment observed in the preceding pottery specimen; the stem hole has been enlarged by gouging, while upon the base is found an ovoidal depression, a grinding surface commonly encountered in the biconical pipes. A somewhat similar specimen, though made from clay, found in the Yazoo River, Mississippi, is figured in Squier and Davis's Ancient Monuments.[1]

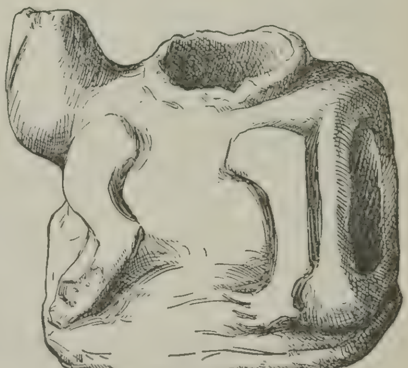

Fig. 157.
BICONICAL ANIMAL PIPE.
Louisiana.
Cat. No. 8648, U.S.N.M. Collected by D. Swift.

The crouching animal (fig. 158) from Hot Springs, Arkansas, collected by Mr. L. H. Thing, made from a soft cretaceous limestone, is 5½ inches long and 4 inches high, with a width of 3 inches. The bowl at its top is slightly raised above the creature's back, and running from its raised rim there is a narrow band to the head, and a slightly broader one extends back until it joins the stem hole. The eyes are depressions carefully cut into the stone, while the mouth is designated by three drill holes barely started. There are lines cut into the face giving to the head a ferocious expression. The nose is represented by two ridges, one of which has been broken away, and over the eye a

[1] Ancient Monuments of the Mississippi Valley, p. 193.

circle is cut into the stone, probably intended as an ornament. Unfortunately, weathering has destroyed a part of the face. The general treatment of this figure gives it a resemblance to certain carvings found in Mexico.

A quartzite figure having a human head (fig. 159), from a flat-top mound near Clarendon, Monroe County, Arkansas, collected by Mr. C. W. Norris, though much larger than the preceding specimens, being 7 inches long, with bowl and stem opening each of a diameter of 1⅜ inches, retains characteristically the biconical type. The material from which this is made is most unusual, for perforated quartzite objects are extremely rare among aboriginal implements, though examples are not unknown. In boring this bowl it is most singular that several small perforations have first been made and subsequently broken into one—a common practice in working stone among European stonecutters, but, it is imagined, unique among Indian implements. On the left side of the back are a number of incised wavy parallel lines, while over the left ear is a disk-like ornamental object. Eyes, nose, mouth, and fingers have been first pecked into shape and subsequently ground. The face is broad and scarcely superior to the work observed upon sculptures from the Easter Islands, though it is by no means the face of an Indian.

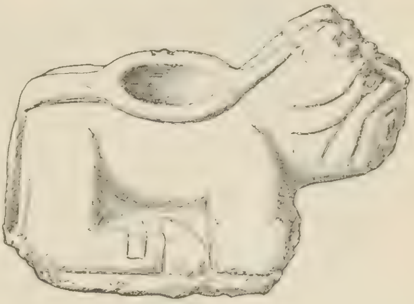

Fig. 158.
BICONICAL ANIMAL PIPE.
Hot Springs, Arkansas.
Cat. No. 83173, U.S.N.M. Collected by L. H. Thing.

Fig. 159.
BICONICAL STONE FIGURE PIPE.
Monroe County, Arkansas.
Cat. No. 71648, U.S.N.M. Collected by C. W. Norris.

In fig. 160 is seen very similar treatment to the preceding figure. This pipe was found in a mound at Kingston, Tennessee, and was collected by Mr. J. W. Dunning. It is but 5 inches long, with a height of 6 inches. The face is typically Indian. The man is represented as crouching on his knees, his left hand lying on the left knee. There is on the head a hat or other covering, while from under it falls on either side a pendant representing the hair. This hat or head gear looks suspiciously like the capote or bonnet of the French voyageur.

Fig. 161 is the cast of a soft white sandstone pipe found in Stoddard County, Missouri, and collected by Mr. T. L. Whitehead. It is 6 inches long and 7 inches high, apparently intended to represent a man creeping upon game. The left knee touches the ground, the right one

Fig. 160.

BICONICAL STONE PIPE.

Kingston, Tennessee.

Cat. No. 23559, U.S.N.M. Collected by J. W. Dunning.

Fig. 161.

BICONICAL STONE HUNTER PIPE.

Stoddard County, Missouri.

Cast, Cat. No. 99343, U.S.N.M. Collected by T. L. Whitehead.

being raised, while in the left hand the hunter holds his bow. There is no right hand or arm, the head and neck of a deer or fawn taking its place. On the back, between the bowl and stem openings, are four or five incised lines somewhat of the character of the Arkansas specimen (fig. 159). The face of the hunter, looking fixedly forward, is of European type. The treatment is highly artistic and could no more be attributed to savage art than could a music box should one chance to be found in a mound.

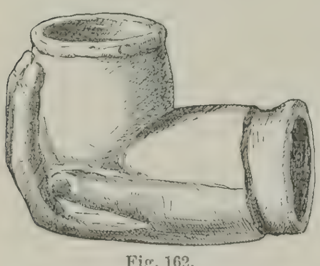

Fig. 162.

BICONICAL POTTERY PIPE.

Mississippi County, Arkansas.

Cat. No. 140884, U.S.N.M. Collected by B. F. Jackson.

Fig. 162 is an almost black pottery pipe 3 inches long, the paste of which it was made being largely mixed with shells, and is strikingly similar in treatment to the stone specimen (fig. 69) from Tennessee. Though this pipe appears to belong to the biconical type, they are so clearly alike as to force the conviction of kinship between them. While the stone pipe has six fingers, both specimens represent the left hand, each holds the pipe bowl, and each has a similar base. Professor Putnam probably refers to pipes of this type upon the opposite side of the river from Madisonville, Ohio, when he says: "For

the first time the large pipes cut in stone in the form of human figures have been found associated with skeletons. This is an important discovery, as heretofore such pipes have only been known from surface finds, although they have been attributed to the people who made the mounds."[1]

IDOL PIPES.

Fig. 163.
IDOL PIPE.
Hollywood Mound, Georgia.
Cat. No. 135216, U.S.N.M. Collected by Cyrus Thomas.

Fig. 163, made of soapstone, is quite complex, and is one of the most interesting of American types found. It is from a mound in Richmond County, Georgia, collected by Prof. Cyrus Thomas. It was found close to the fire bed of Hollywood Mound and not many inches from a copper ax. In about the same layer were also found bits of china and iron nails, sufficiently strong evidence, one would suppose, to prove the contemporaneous presence of whites and Indians. This pipe belongs to what Mr. Charles C. Jones designates as "the idol pipes, which are attributed to the men who threw up those large mounds which tower along the banks of the Etowah River, always associated, as far as we know, with large pentagonal and quadrangular mounds."[2]

It should be observed that two of the three pipes here figured of persons holding bowls have their stems much smaller than are those of the biconical pipes, and the one from the Etowah Mound made of pottery has a stem of the same type as the rectangular pottery pipes from Georgia.

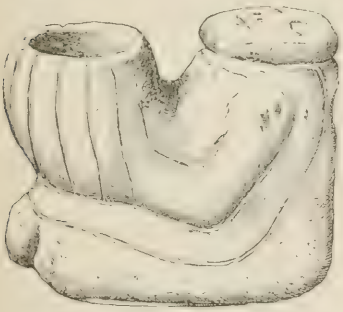

Fig. 164.
IDOL PIPE.
Monroe County, Arkansas.
Cat. No. 71649, U.S.N.M. Collected by C. W. Norris.

Fig. 164 was found in association in the mound in Monroe County with fig. 159, and is $4\frac{1}{2}$ inches long and 4 inches high, with a width of $2\frac{3}{4}$ inches, and is made from an imperfectly crystallized quartz, the arms and hands clasping the vessel constituting the bowl of the pipe. The head is an extremely rude carving, treated in a most primitive manner, the eyes being mere circular incisions cut on a flattened disk by means of a pointed tool; the nose is represented by two spots drilled slightly

[1] F. W. Putnam, Peabody Museum Report, III, p. 500.
[2] Antiquities of the Southern Indians, p. 402, New York, 1873.

into the material, a straight incised line answering for the mouth. Up and down the bowl are a number of equidistant parallel lines intended for ornament, though the work appears to be done with stone tools. Though the size of the stem in proportion to that of the bowl decreases in this class, the biconical features are largely retained. Schoolcraft figures an "idol pipe" similar to those here shown from near Brownsville, on the Ohio River.

Fig. 165, while rude in execution, exhibits similar artistic ability to that evidenced in the two preceding pipes. It is made of pottery and represents a person clasping a bowl somewhat in the manner represented in the other figures, though leaving no doubt that each represents contemporaneous art. This pipe is from the Etowah Mound, in Bartow County, Georgia, collected by Dr. Roland Steiner, and has unfortunately had the head broken from the body. Here in the inclosure also appear to have been found objects of European manufacture. The clay of which this pipe is made does not appear to contain tempering material, and another noticeable feature and deviation from the type is the decreased size of the stem and its similarity to certain other pipes found in this mound which the writer will show to be probably quite modern and similar in characteristics to pipes found in the Hollywood Mound, Richmond County, Georgia, where also objects of European origin were discovered.[1]

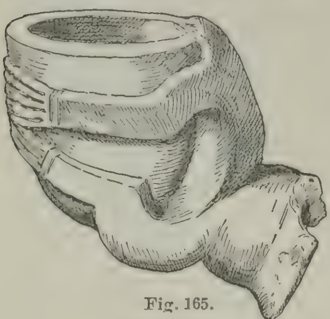

Fig. 165.
IDOL PIPE.
Etowah Mound, Georgia.
U. S. National Museum. Steiner collection.

A similar pipe is evidently referred to in the description of one found in the stone graves of Tennessee, from which Professor Putnam says "only eight pipes had been found in the opening of several thousand graves, among which was a clay pipe with an ornamented bowl, two others were of pottery, and all the rest of stone; one of the latter elaborately carved, representing a man holding a cooking pot, which formed the bowl of the pipe."[2]

GREAT PIPES.

Fig. 166 is the cast of a pipe said to be from Kentucky, collected by Mr. H. A. Ward, and appears to be an unfinished "great pipe" of the Indians, which had been hammered into shape but never finished. It is 10 inches long, 8½ inches wide, and 6 inches high, representing a bird with extended wings, as though in the act of flying. A striking peculiarity of this pipe is that the depression in the breast is the only evidence in the cast of a stem hole, and is unfinished. If this be the case in the original, it is the only specimen of this type of pipe where the

[1] Cyrus Thomas, Twelfth Annual Report of the Bureau of Ethnology, p. 323, plate.
[2] Peabody Museum Report, III, p. 165.

stem does not enter at the back of the object. There is in the U. S. National Museum a cast of a somewhat similar pipe from Mississippi. and yet another in the Douglass collection.

One of the most elaborately ornate pipes known (fig. 167) is from Lexington, Kentucky, collected by Mr. J. Peter, which is 10 inches in its greatest length, 9 inches high, and 2½ inches wide, the bowl being 1⅝ inches in diameter, while that of the stem, which is under the bird's tail, has a diameter of only three-fourths of an inch. The bowl and stem are at right angles to each other, having been bored by means of solid drill points. This pipe represents a bird sitting in an erect position, with its eyes, wings, and tail feathers conventionally carved into the green steatite of which the pipe is made. Reverse this, however, with the bowl upon a flat surface and the bird on its back, and the specimen becomes a rude but very distinct carving of a human head and neck, and, though the ornamentation of this specimen is rudely conventional, it so distinctly represents a white man's conception of the treatment as to almost preclude other hypothesis. This belief is strengthened by a coin or medal of silver struck off during the Commonwealth, which, when held erect, represented the head of Cromwell, and being turned upside down, showed a caricature of someone else of the period. While the Commonwealth would suggest a date about 1649–1659, the pipe might be of any period thereafter. Not-

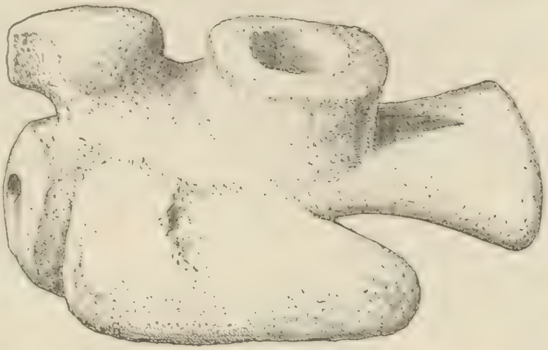

Fig. 166.
GREAT PIPE.
Kentucky.
Cast, Cat. No. 21291, U.S.N.M. Collected by H. A. Ward.

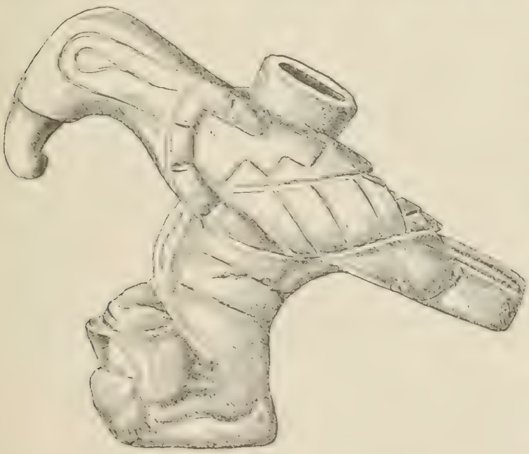

Fig. 167.
GREAT PIPE REPRESENTING MAN AND BIRD.
Lexington, Kentucky.
Cat. No. 16687, U.S.N.M. Collected by J. Peter.

withstanding the fact of this pipe being influenced by modern art, the work upon it is primitive in its character, though the lines have been incised with sharp-edged tools. There is in the U. S. National Museum collection another biconical pipe made of a soft yellow sandstone in imitation of a bird sitting on a perch, which was found in Maury County, Tennessee, the outlines of which are distinct though the specimen itself is quite rude. Squier and Davis also represent several pipes in human form, the persons figured being in a crouching position, one other being that of an animal showing its teeth in a formidable manner.[1] Schoolcraft also figures a pipe of this type.[2]

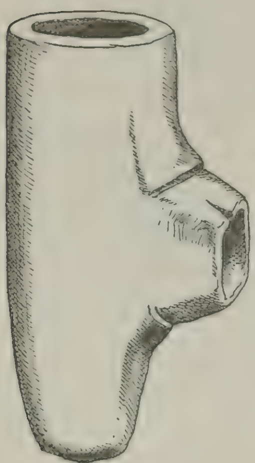

Fig. 168.
INDURATED CLAY PIPE.
Knox County, Tennessee.
Cat. No. 146353, U.S.N.M. Collected by Norman Spang.

A carefully ground though unfinished pipe from a mound in Knox County, Tennessee, collected by Mr. Norman Spang (fig. 168), is made of brown stone, its greatest length being 2½ inches. It was evidently intended to be smoked by inserting the stem in the shouldered opening and holding the pipe by its elongated base, as appears to have been done with the disk pipes. The striæ of the drill yet remain distinct both in bowl and stem opening. Both above and below the stem extension from the bowl the tool marks are quite distinct, the shoulders having been formed by a sawing process.

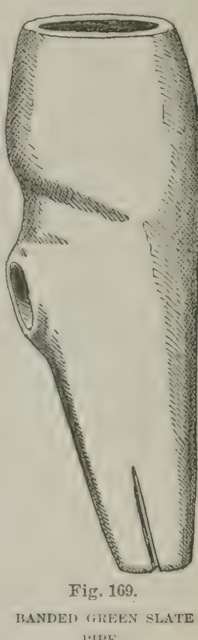

Fig. 169.
BANDED GREEN SLATE PIPE.
Dubuque, Iowa.
Cat. No. 42545, U.S.N.M.
Collected by H. T. Woodman.

Fig. 169 is a graceful pipe of the preceding form and is also a mound specimen from near Dubuque, Iowa, collected by Mr. H. T. Woodman. It is made of a banded green slate, the whole surface of which has been ground with extreme care. The incision on the side of the prolongation of the bowl has been sawed in on each side and across the end as though intended to represent the mouth of some animal. This belief is strengthened by two depressions on the point, drilled with a rough pointed tool, probably a stone, or, if of metal, one which was quite dull, as evidenced by the striæ, these depressions apparently being intended to represent the nostrils.

[1] Ancient Monuments of the Mississippi Valley, figs. 75, 146, 148, 149.
[2] Henry R. Schoolcraft, Indian Tribes of North America, Pt. 1, plate 13, fig. 2.

Somewhat similar in outline, though with the position of the bowl reversed, is fig. 170, a pipe of steatite from Boone County, Missouri, collected by Mr. Charles J. Turner. It appears to be made in imitation of a duck's head; the eyes are represented by shallow depressions on each side, the mouth being incised and following in a graceful curve the contour of the outline of the specimen. The slight exterior enlargement of the end of what appears to be intended as the stem would indicate that those who made this pipe were familiar with pipes of some plastic material.

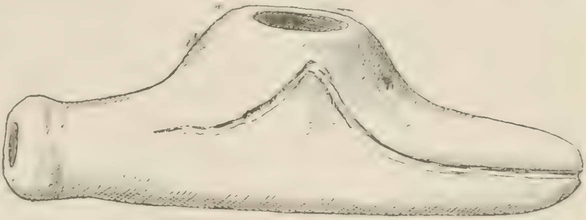

Fig. 170.

STEATITE PIPE.

Boone County, Missouri.

Cat. No. 62031, U.S.N.M. Collected by Charles J. Turner.

In addition to the clay pipe with a double stem from Mississippi herein referred to, there are in the U. S. National Museum two pipes made of stone which have both stem and bowl duplicated. Fig. 171 is a pipe of this character. It is made of a gray chlorite and was found in Rhea County, Tennessee, by Mr. A. M. Rickley. In its greatest length it measures 4½ inches, with a thickness of 1¼ inches. Through this stone a hole has been drilled from side to side. There are separate bowls and separate stems on the opposite sides of this discoidal implement. The bowls appear to have first been pecked into shape and subsequently reamed out about one-fourth of their depth, whereas the stem holes yet show distinctly the striæ of the solid drill with which they were made.

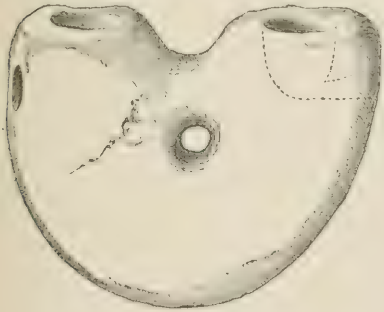

Fig. 171.

BRIDEGROOM PIPE.

Rhea County, Tennessee.

Cat. No. 172316, U.S.N.M. Collected by A. M. Rickley.

Another of these double pipes (fig. 172) is from Columbia, South Carolina, collected by Mr. A. R. Crittenden. It is made of a compact black slate, which has a much more modern appearance than the preceding pipe; besides this, the bowls are one above the other, and to smoke both at the same time could only be done by turning them on the side, and even in that position it would be difficult of accomplishment. The two heads of what appears to be a duck both point in the same direction and each have mouths and eyes represented, though, as so often observed in such cases, the creature is somewhat difficult to recognize. On the opposite side of this pipe to that shown there is in

one corner a cross in form of the swastika, and near the center the letters I N. The work on this pipe has evidently been done with sharp-edged cutting tools, and in one place the marks of a rasp or file are quite distinctly shown by equidistant lines of similar length.

Prof. G. H. Perkins has illustrated a steatite pipe with two bowls and a single stem opening, from Swanton, in the northern part of Vermont, which is well polished, and is said to have been cut out instead of being bored, as is usual in Champlain Valley pipes.[1]

Mr. David Boyle has also described a pipe very similar to the last one, found in Harvey Township, Peterboro County, Ontario, made of pottery, the bowls of both of which open into each other immediately below the point of junction of the double bowl.[2]

The great difference in form of the double-stemmed or double-bowled pipe or in double pipes of any kind found in America would indicate that they were not made according to any fixed rule, but rather to suit individual fancy; though the specimens described are too few to allow of positive expression of opinion concerning them other than that such pipes have bowls and stems usually of modern form, though even this rule has its exceptions. There is said to have been an old Dutch custom of smoking a double pipe on one's wedding day, which was never again used except upon the wedding anniversary. Two such pipes, known as Dutch bridegroom pipes, were in the celebrated Bragge collection, now in the British Museum, and are referred to as "still decorated with the ribbons placed upon them upon a certain festal day that faded into nothingness two centuries ago. The bridegroom pipe was one of the household gods of Holland. Smoked in augury of a happy future upon the wedding day, it was held too sacred to be touched again save on the recurrence of the anniversary of the momentous event."[3]

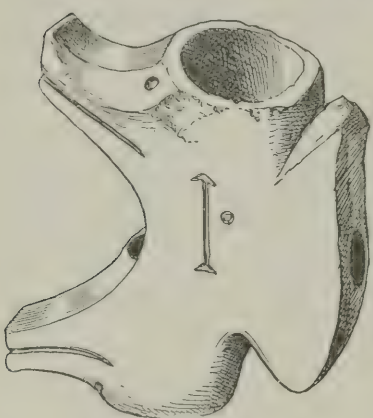

Fig. 172.
BRIDEGROOM PIPE.
Columbia, South Carolina.
Cat. No. 34329, U.S.N.M. Collected by A. R. Crittenden.

THE CALUMET DANCE.

The derivation of the word "calumet" has been discussed, yet this word to one at all familiar with the colonial history of the French in America has an especial significance and means more than a mere pipe. It constituted a peace offering combined with a flag of truce. It was supposed to secure the safety of its bearers during the function of its presen-

[1] The Calumet in the Champlain Valley, Popular Science Monthly, December, 1893, p. 241.

[2] David Boyle, Archæological Report of the Minister of Education of Ontario, 1894–95, p. 58, fig. 28.

[3] The Bragge Collection, p. 3, referred to in Cope's Tobacco Plant, December, 1880.

tation, smoking, and the attendant deliberations, and it was further said to protect those who carried it as far as the borders of the country of the people visited, though there are several references to exceptions to this rule.

If the pipe tendered was accepted peace was acknowledged, while if the pipe was rejected it was war literally "to the knife." Warlike messages were accompanied by red pipes; peaceful messages were accompanied by pipes which were white or so colored for the occasion; even the feathers decorating the pipestem had their special and separate significance, and strangers could tell from the shape of the pipe and its decorations who the people were from whence it came, and the general character of the mission before the messengers spoke. The age of the custom can not be stated with any degree of certainty, though the pipe was apparently used in feasting and on solemn occasions from an early period. The French adopted it as an emblem of peace about 1673, as we learn from Marquette, and later it was also employed by the English, until eventually it became a prevalent custom throughout the larger part of the continent, though the early English emblem in intercourse with the natives appears to have been the collar of wampum, which later became the wampum belt. There is reason to suppose that the native offering of incense to Cortez and his followers was often a tobacco offering of propitiation to creatures from another world, such as was burned to propitiate their fetiches, for tobacco and other plants, from a pre-Columbian era, have played an important part in the sacred dances of the natives, and it may be doubted whether even now the Indian does not connect the burning of herbs with the more mysterious of the affairs of life. Eventually in all transactions between the whites and natives a pipe was smoked; even in social visits the Indian offered his pipe as a welcome, as the Russian or the Arab does salt. Some early references to smoking and other pipe customs are of more than passing value in the study of American pipes. Those quoted are given chronologically, beginning with Raleigh's expedition in 1586, when, according to Stith, "Sir Walter sent upon this voyage a domestic of his, one Mr. Thomas Hariot, and highly in his patron's intimacy. He likewise tells of the great esteem and veneration in which the natives held a plant, which grew spontaneously in the country, and was by them called *uppowoc*, but it is now well known by the name of tobacco; derived, it is said, from the island of Tobago, one of the Caribbees in the West Indies, where it grew in vast quantities. The leaves of this they cured and dried, and then being rubbed into a sort of bean and dust they put it into earthen tubes and drew the smoke through the mouth. They thought this plant of so great worth and value that even the gods themselves were delighted with it. And therefore they sometimes made sacred fires and instead of a sacrifice threw in this dust, and when they were caught in a tempest they would sprinkle it into the air and water; upon all their new fishing nets they would cast some of it; and when they had escaped any remarkable danger they would throw some of this dust into the air, with strange distorted gestures, sometimes striking the earth with their feet in a kind of time and measure;

sometimes clapping their hands and throwing them up on high, looking up to the heavens and uttering barbarous and dissonant words."[1]

This is the first account north of Mexico of the dance of the calumet, of which the French travelers so often speak, and which the Omaha and other tribes yet indulge in. According to Hakluyt, Hariot remarks that—The uppowoc is of so precious estimation among them that they think their Gods are marvelously delighted therewith, whereupon they sometimes make hallowed fires and cast some of the powder therein for a sacrifice: being in a storm upon the waters, to pacify their Gods, they cast some up into the air and into the water; so a weare for fish being newly set up they cast some therein and into the air; also after an escape of danger they cast some into the air likewise, but all done with strange gestures, stamping, sometimes dancing, clapping of hands, sometimes holding up of hands and staring up into the heavens uttering therewithall and chattering strange words and noises. We ourselves during the time we were there used to suck it after their manner, and also since our return, and have found many rare and wonderful experiments of the virtues thereof, of which the relation would require a volume by itself, the use of by so many of late, men and women of great calling and some learned Physicians, also is sufficient witness.[2]

Capt. John Smith, a few years later (1607), speaking of the "Werowance" of "Rappahanah," says "he caused his mat to be spread on the ground, where he sat down with a great majesty, taking a pipe of tobacco, the rest of his company standing about him," and he further says "there was a garden of tobacco there. * * * These people have a great reverence for the sun above all things, at the rising and the setting of the same they making a round circle on the ground with dried tobacco, then they began to pray."[3]

Somewhat after the same manner Smith, in 1608, says: "When the waters begin to run high they haste away to the seaside or the banks of the rivers, and after several invocations and outcries made, they throw tobacco, copper, and other trash into the water, this is in order to appease that power which they believe to be very angry upon such occasions, and must have some such offerings made him before he will be quiet again."[4]

William Strachey, in 1612, evidently referring to this paragraph, quaintly says: "They have also another kind of sorcery which they use in storms—a kind of botonomantia with herbes: when the waters are rough in the rivers and seacoasts their conjurers run to the waters' sides. After many hellish outcries they cast tobacco, copper, or such trash into the water to pacify that god whom they think to be very angry in those storms."[5]

[1] William Stith, History of the first Discovery and Settlement of Virginia, pp. 17, 19, Sabin reprint, New York, 1865.

[2] Thomas Hariot, Hakluyt's Voyages, III, p. 330, London, 1810; reprint of London edition of 1600.

[3] A Discourse of the Plantation of the Southern Colony of Virginia in Introduction to Arber's edition of Smith's Works, pp. lxviii–lxxi, Plate xv, quoting G. Percy.

[4] John Harris, Voyages and Travels, I, p. 846, London, 1705.

[5] Historie of Travaille into Virginia, p. 93, (Hakluyt Society).

Father White, in 1633, also refers to a function akin to this then prevailing in Maryland. "On an appointed day," he says, "there assembled around a great fire all the men and women from many parts of the country. A space being cleaned some one produces a large bag: in the bag is a pipe and some powder which they call "potu." The pipe is such as our countrymen use for smoking, but much larger. Then the bag is carried around the fire, the boys and girls following and singing in an agreeable voice alternately, "Taho," "Taho." The circle being ended the pipe is taken from the pouch with the powder. The powder is distributed to each of those standing around and lighted in the pipe, and each one smoking it breathes over the several members of his body and consecrates them."[1]

There is in these descriptions striking similarity to the calumet dance later witnessed on the Mississippi by Marquette and other French pioneers.

This dancing and clapping of hands appears analogous to the practices of the Natchez, who were said to "venerate the sun, which was evidenced by offerings made to it at its rising and setting;" the officiating functionary was probably a pipe chief or medicine man, such as have been referred to as officers of many of the tribes as far north as the Great Lakes. The pipe bag, pipe, and "potu" reminds one of customs yet kept up among the Pueblos of the Southwest. Holm, in his description of New Sweden, says "almost all the Indians in the northern part of America make use of a token of peace and friendship with which they confirm all that their councils have determined upon, whether it be war or peace, or any other important business."[2]

The Nadousses, according to Raymbault and Jogues, in 1642, were said to "cultivate the land after the manner of the Hurons and reaped corn and petun."[3]

These people were Siouan and appear to have lived in the vicinity of Sault Ste. Marie, in Chippewa County, northern Michigan, and a knowledge of them at this early period would suggest an acquaintance with the country between Lake Erie and the southern part of Lake Michigan, and a propable acquaintance with the waters of the Mississippi itself years prior to Marquette's trip down the river in 1673.

In 1553 the French made peace with the Iroquois at Isle Orleans, in the country of the Hurons, near Quebec, and in the account given of the proceedings by Lescarbot the Indians appear to have followed a practice recorded on many other occasions between the natives and whites of dividing their speeches into parts, each part being accompanied by separate presents, as evidenced with the French by the pipe: if with the English, the speeches were evidenced usually by the wampum belt; which practice continued with slight variation to the period of the Revolution of the colonies.

[1] Father Andrew D. White, A Relation of the Colony of the Lord Baron of Baltimore, in Maryland, near Virginia, Forces Tracts, IV, No. 12, p. 24.

[2] Thomas Campanius Holm, A Short Description of the Province of New Sweden, now called by the English, Pensylvania, p. 134, Philadelphia, 1834.

[3] Pierre Margry, Découvertes et Etablissements des Français, Les P. P. Charles Raymbault et Isaac Jogues, p. 47, Paris, 1875.

Their captain installed his presents, which pass with all the savages as writings do with us, or as contracts do. Everyone being seated, he raised himself and invoked the sun as a witness of his thoughts, as a torch which banished the night and darkness of his heart and gave day to his words. The presents consisted of beaver skins and porcelain (wampum beads), and each had its name and made evident the desire of him who spoke and those who sent him.

The first, to dry the tears shed for braves killed.

Second. A talisman to prevent vindictiveness of the French for the loss of their people.

Third. A covering for the dead to prevent the recurrence of old quarrels.

Fourth. To keep the dead buried and to prevent them from leaving their graves and showing animosities.

Fifth. To pack up their arms that they might not again be touched.

Sixth. To purify the stream soiled with blood.

And last, to exhort the Hurons to agree to what Onontio decided about the peace.

In reply the governor made speech for speech and present for present.[1]

According to I. A. Lapham "the first white persons who penetrated into the regions of the upper lakes were two young fur traders who left Montreal for that purpose in 1654 and remained two years among the Indian tribes on their shores. It appears that they returned with information relative to Lake Superior and perhaps Lake Michigan and Green Bay, for in 1659 fur traders are known to have extended their traffic to that bay."[2]

"The Sonontonans" (Senecas, Hewitt) "to the number of fifty or sixty assembled in our cabins. Their custom is, on entering, to take the first vacant place, without regard to rank, and at once take fire for lighting their pipes, which are not taken from their mouths during the whole time of the council. They say that good thoughts come with smoking."[3] And among the presents enumerated on the occasion were capots, cooking pots, beads, etc.

At a council in the year 1670 on the shores of Lake Ontario, which Comte de Frontenac held with the Onondagas, Mohawks, Oneidas, Cayugas, and Senecas, he said: "I have lighted a fire to see you smoke (petuner) and to talk to you."[4] Among other things presented at this council were 25 capots.[5]

The French, after their settlement on the Ohio, sent out their fur traders and presumably their fur hunters, who eagerly sought for new fields where the game had not been thinned out and which afforded the most abundant supply. These traders and hunters were the first per-

[1] Marc Lescarbot, Relation de la Nouvelle France, p. 19.

[2] I. A. Lapham, Wisconsin; its Geography and Topography, p. 18, Milwaukee, 1846.

[3] Pierre Margry, Découvertes et Établissements des Français, Relation de l'Abbe de Gallinee, p. 128, Paris, 1875.

[4] Pierre Margry, Découvertes et Établissements des Français, Voyage de M. le Comte de Frontenac au lac Ontario, p. 212, Paris, 1875.

[5] Idem, p. 223.

sons who trod the soil of those States bordering the Great Lakes. It was probably from such persons that the Susquehannocks obtained the articles of European manufacture found in their possession at the head of Chesapeake Bay in 1608, probably by way of Lake Ontario and across from some of its affluents down the Susquehanna. Missionaries, according to Caleb Atwater, "were sent to Onondaga in 1654. From this time forward the French are known to have traversed that part of Ohio which borders on Lake Erie and the Ohio River."[1]

The missionaries were early in the field, but it appears natural to suppose that they would select those territories which offered the most promising fields of work. This information would naturally be imparted by trappers and traders. Lafitau says: "Father Marquette, a Jesuit missionary to Canada, embarked with Sieur Joliet, a French Canadian, to discover the western sea and to attempt to find a way from Canada to China, and was the first of the French to penetrate to the Mississippi River. This was the 17th of June, 1673—that is to say, six or seven years before La Salle went to take possession of the country in the King's name. They followed the Wisconsin River until it fell into a larger river about 42½° of north latitude. They dropped with the current to within two or three days of the Gulf of Mexico, but noticing they were going from their course and fearing the Spanish, returned by way of the Illinois to Missilimackinack" (crossing to the lake at the portage about Chicago). It is in the relation of the voyage of Father Marquette down the Mississippi that he mentions first the calumet of peace, and as he is the first who speaks of it, he is also the one who speaks best. He says:

It was the 25th of June the Indians, having recognized them as Europeans, sent four old men to speak with them. Two of them carried pipes to smoke tobacco in; they were highly ornamented and adorned with feathers of different sorts. They walked solemnly and raised their pipes toward the sun; they appeared to present it to him to smoke without, however, saying a word. They were quite slow in passing over the short distance from the village to them. Having reached them they stopped and looked at them with attention. The Father, reassured by this ceremony, spoke first to them and asked who they were; to which they answered they were Illinois, and to guarantee peace they presented their pipes to smoke; then they invited them to enter their village. One should not refuse the pipe unless he would be taken for an enemy, but it is enough to make out he is smoking. It is sufficient if one carries the calumet with him to show it, by which means he may walk in safety among enemies who, in the midst of fighting, will lower their arms to one who shows it. It was for this reason the Illinois gave this pipe as a safeguard among the nations through which they had to journey. There is a calumet for peace and one for war. They use them to end their differences, for strengthening alliances, and to communicate with strangers.

It is made of a red stone polished like marble, and pierced so that one end serves to receive the tobacco, and the other has a socket for a handle, which is a stick 2 feet long, as large as an ordinary cane, and pierced through the middle. It is ornamented with the head and neck of different birds of the most beautiful plumage, to which

[1] Caleb Atwater, Description of the Antiquities of the State of Ohio, Archæologia Americana, I, p. 116.

they add also large red, green, and other colored feathers. They regard it as coming from the sun, to whom it is offered to smoke when they want calm or rain or sunshine. They fear to bathe in summer or to eat new fruits without having danced to it as follows: This calumet dance, which is very celebrated among these people, is not performed except on serious occasions; sometimes for making peace, or to reunite them for a great war, or for public rejoicing; sometimes for a nation's assistance; at times they use it at the reception of a person of considerable importance, as though to offer a ball or comedy. In winter the ceremony is held in a cabin; in summer out in the air. The place being selected they surround it with trees, in order to shade the whole assembly. There is spread out a large mat of reeds, painted different colors, in the middle of the place, which serves as a carpet for the god of him who makes the dance; for each one has his own, which is called his Manitou. It is a serpent, or a bird, or a stone, or some similar thing of which they have dreamed and in which they put every confidence for success in the war or chase. Sitting near this Manitou and on his right is placed the calumet in honor of the one who has given the feast; the arms, such as clubs, hatchets, bows and quivers, such as they use, are laid around it. Things being thus arranged, those having the best voices, who are to sing, take the most honorable place under the trees. All the world then comes and take their places around them, and as each one arrives he salutes the Manitou, which he does in smoking and blowing the smoke upon him, as though offering incense. Then the one who is to commence the dance appears and goes respectfully and takes the pipe and holding it in both hands he dances it in rythm with the song. He makes it describe different figures; at times he presents it to the company and turns it from side to side, then he offers it to the sun as though he wished him to smoke it; at others he inclines it toward the earth; sometimes he spreads the wings as though he wished it to fly; at other times he places it in the mouths of the assistants that they make smoke it, all in rythm, and it is like the first scene of the ballet. The second scene they imitate a combat and go through an imaginary fight, one with arms and another with the calumet. The third scene is a discourse, in which the one who holds the calumet tells of his victories and it is passed from hand to hand until all have had a chance to smoke.[1]

These Illinois belonged to the great Algonquin linguistic stock, as Marquette informs us, which reached from approximately the thirty-fifth to the fifty-fifth degree of latitude on the east side of the Mississippi.[2] The Sioux being their neighbors on the west bank of the river, from about latitude 33° to latitude 53°. Marquette states that these Illinois had never before seen Frenchmen,[3] though they must have been quite familiar with them, as he refers to their skill in the use of the rifle with which they are supplied by the Indians who trade with the French, and which he says makes them formidable to their enemies.[4]

This pipe Marquette describes as being larger than the common tobacco pipe of the French.[5] It should be observed here that the Illinois pipe referred to answers fully the description of the red Siouan catlinite; and it is hardly possible, when we consider the minuteness of description of the stem and its ornamentation, that had the primitive

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[1] Mœurs des Sauvages Amériqains, II, p. 314, Paris, 1724. See also Marquette and Joliet, An Account of the Discovery of some new Countries and Nations in North America, 1673, Historical Collections of Louisiana, Pt. 2, p. 287, New York, 1852.

[2] See map accompanying Seventh Annual Report of the Bureau of Ethnology.

[3] Marquette and Joliet, Historical Collections of Louisiana, Pt. 2, p. 287.

[4] Idem, Pt. 2, p. 288.

[5] Idem, Pt. 2, p. 289.

Illinois pipe been carved with animals upon its stem that so important a feature would have been passed over by Marquette without allusion to it, and as a further evidence of the curved-base mound pipe owing its elegance of form to European influence the locality where Marquette received the pipe was in the area of the mound type.

The calumet in the dance is used to defend the bearer from the attack of the warrior who has taken the bow and arrow from the mat[1] mentioned. Marquette refers to the Ouabouskigon River, which runs into the Mississippi from the east about latitude 36° north,[2] referred to in the text as the Ohio. Marquette was told, by the natives, of Europeans on the lower part of the river who lived to the east and who had images and chaplets and played upon musical instruments and from whom they bought their goods.[3] The pipe given to Marquette by the Illinois, and its value as a safeguard is referred to in a letter of November 11, 1674, from Frontenac to Colbert.[4]

In 1676 Father Allouez refers to the Illinois offering to him the calumet. "The chief," he says, "advanced about thirty steps to meet me, holding in one hand a firebrand and in the other a feathered calumet. As he drew near he raised it to my mouth, and himself lit the tobacco, which obliged me to pretend to smoke."[5]

Father Louis Hennepin refers to the calumet of peace in 1679 among the "Iroquese," in the vicinity of Niagara somewhat differently from Marquette's allusions. The latter refers in his travels to more than one place where his pipe was not received. Hennepin says: "It is a large tobacco pipe of red, black, or white marble, with a finely polished head. The quill, which is commonly two foot and a half long, is made of a pretty strong reed or cane adorned with feathers of all colours interlaced with locks of women's hair. Every nation adorns it as they think fit and according to the birds they have in their country. Such a pipe is a safe conduct amongst all the allies of the nation which has given it, and in all embassies the calumet is carried as a symbol of peace, the savages being generally persuaded that some great misfortune would befall them if they should violate the public faith of the calumet."[6]

Fathers Hennepin and Gabriel in 1679 visited Niagara Falls, "the like whereof," Hennepin says, "is not in the whole world."[7] The pipe is there illustrated, and if the illustration is correct, as it presumably is, would by its form indicate the Siouan type.

It should be remembered that Lafitau says the Iroquois and Indians near Quebec and on the St. Lawrence did not use the calumet of peace.[8]

McCulloh is probably correct in his assertion in reference to Hen-

[1] Marquette and Joliet, Historical Collections of Louisiana, Pt. 2, p. 290.

[2] Idem, Pt. 2, p. 292.

[3] Idem, Pt. 2, p. 293.

[4] Pierre Margry, Découvertes et Etablissements des Français, Retour de Louis Joliet, p. 260, Paris, 1875.

[5] Narrative of Father Claude Allouez, Historical Collections of Louisiana, p. 73.

[6] Louis Hennepin, A Voyage to North America, Archæologica Americana, I, p. 70.

[7] John Harris, Voyages and Travels, II, p. 907, London, 1705.

[8] Mœurs des Sauvages Amériqains, II, p. 314, Paris, 1724.

nepin's remark that in 1679 the calumet was in universal use among the Indians east of the Mississippi. He says: "It is not improbable, however, that at that time the French traders had both greatly extended its use and confirmed its character of conferring personal inviolability, as such a practice favored their traffic into the interior parts of the country."[1]

Membre in 1681, in referring to La Salle's voyage to the mouth of the Mississippi, refers to the "Arkansa" and "Taensa" as being half civilized. The Quinipissa, however, when La Salle sent messengers, let fly arrows at them. These people, he said, had never seen guns. With the Mohegans also the calumet was not received. The Indians on the lower river told them of people to the west who rode upon animals, and showed them two hoofs, which were those of horses.[2]

When they upon their return reached the Miami they learned of the Sieur de Tonty, who since leaving them had made several military expeditions.[3]

Baron Lahontan refers to the use of the calumet in Canada in a manner very similar to Marquette and La Salle, and gives some data which yet more strongly indicate that the calumet was of the Siouan type. The stem, he says, was 4 or 5 feet long, and the mouth or head in which the tobacco is held is 3 inches long, its figure approaching that of a hammer, the body being 8 inches long, and that the effect of the pipe was similar to that of a flag of truce with the French,[4] which strengthens the suggestion of McCulloh that this was a belief which the French would do everything to confirm.

La Salle, in describing the calumet dance of the "Arkansa," gives a very similar account to that given by Marquette as prevailing in the Illinois tribe, which is quite similar to a like custom described in Virginia, and would indicate an ancient practice. He says: "The Indians before dancing put poles around, as when linen is dried, and arrange on them all they are going to give. Then they bring two calumets made of red stones and filled with tobacco, being adorned with feathers of all colors. The chiefs and warriors have gourds full of pebbles, and also two drums. These are pots of earth covered with skin over the top. Those who have done great deeds strike a post, which is planted in the middle of the council place, with a club. Having told of their powers, they gave M. de La Salle their presents. If anyone lies the one who knows it wipes the post with a skin to remove the lie. The French, with the exception of M. de La Salle, also struck the post and related their achievements."[5]

The first reference to there being any special difference in the pipes used at a council and those used by the individual is probably that

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[1] James H. McCulloh, Researches, p. 146, Baltimore, 1829.

[2] Father Zenobius Membre, Narrative of La Salle's Voyage Down the Mississippi, Discovery and Exploration of the Mississippi Valley, p. 174. Redfield, 1852.

[3] Idem, p. 178.

[4] Baron Lahontan, Some New Voyages into North America, p. 36, London, 1703.

[5] Pierre Margry, Découvertes et Établissements des Français, Recit de Nicolas de La Salle, 1684, p. 553, Paris, 1875.

regarding Garangula, an Onondaga chief, who in 1684 sat at council "with his pipe in his mouth and the great calumet of peace before him."[1]

"M. de La Barre, in conference with Garangula at Kaihoga, asks him to smoke the calumet and to promise, in the name of the Senecas, Cayugas, Onondagas, Mohawks, and Oneydoes, to leave the French King's subjects unmolested. If they do not so agree, he says, he will declare war with them, and says this belt will confirm my words." Garangula, the spirited sachem who was a leader among the Onondagas and one of the head-men of the Confederacy of the Five Nations, does not take kindly to the terms, which he refuses in a spirited speech. He refers to the calumet which the Five Nations had given the governor's predecessor, and closes by the remark: "This belt preserves my words."[2]

The council here referred to grew out of trade jealousies more than anything else, for the French were anxious to cause the Iroquois to trade with them rather than the English, and the language employed upon one side and the other was unmistakable in its significance. La Barre informed the Indians that the Five Nations had robbed and abused all the traders that were passing to the Illinois and to the other nations—children of his king. Garangula was not to be outdone in the force of language employed, and informed La Barre that he thanked him in the name of the confederated tribes for bringing back into their country the calumet which the predecessor of La Barre had received from their hands. And referring to the protection of the calumet, he informed the governor that it was happy for him "that you left underground that murdering hatchet."[3]

Lahontan, in 1693, referring to the Indians making peace, says: "It is never until after a long war that the savages try to enter into a treaty, but after they see it is to their interest to make peace they send five, ten, or twenty warriors to make peace proposals to their enemies. Sometimes these envoys go by land, at other times by water, carrying always the great calumet of peace in the hand, after the manner of a cornet carrying his standard."[4]

In all treaties and councils between the whites and Indians, the pipe and wampum belt appear to go hand in hand. The pipe was a prerequisite to all functions with the Indians, whether among themselves or with strangers, whereas, as has been observed, the belt was often the witness of the specific contract. Its bands, beads, and color, the very arrangement of its design, each conveyed a specific message; not as a hieroglyph, for symbolism in this shape does not appear to have prevailed among the Indians using the belt, although they did at times resort to a rude ideography or pictography on rocks, bark, and skins; nor was it used as the quipu was said to be employed by the Peruvians and which could be read by certain persons learned in the art of deciphering the knotted cords—an art by the way apparently not con-

[1] Baron Lahontan, Some New Voyages into North America, I, p. 35, London, 1703.

[2] Cadwallader Colden, History of the Five Nations of Canada, p. 65, London, 1724.

[3] Idem, I, p. 68.

[4] Baron Lahontan, Mémoire de l'Amérique Septentrionale, p. 187, Hague, 1703.

fined to America. The belt was used to remind the orator for the time of his speech or lesson prepared before leaving the tribe on a mission, which, if forgotten, would be instantly corrected by his companions present, and when this belt had served its specific purpose, upon occasion it would be used as a witness to another and possibly entirely different contract. Lahontan has referred to these belts or "coliers," as the French usually designate them, as being "certain swathes of 2 or 3 feet in length by a breadth of 6 inches, decked with little beads made of certain shells that are found upon the seashore between New York and Virginia. These beads are round and as thick as a green pea, but are twice as long as a grain of corn. Their color is blue or white, and they are bored through like the pearl being run after the same manner upon strings which lie sideways to one another. Without the intervention of these *coliers* there is no business to be negotiated with the savages; for being altogether unacquainted with writing, they make use of them for contracts and obligations. Sometimes they keep a belt for a generation which has been received from their neighbors, and, in this respect, every belt has its own peculiar mark. They learn from the old persons the circumstances of the time and place where they were delivered, but after that is over they are made use of for new treaties."[1]

Maj. Richard Ingoldsby, commander in chief of the province of New York, on the 6th of June, 1692, presented to the "sachims of the Five Nations or cantons westward—namely, Maquaes, Oneydes, Onnondages, Cayouges, and Sinnekes—in the city hall of Albany, 6 gross of pipes and 100 pounds of tobacco."[2]

Sanvole, in Louisiana, in 1699, speaks of giving the Indians small presents of glass beads, knives, and hatchets, for conducting M. De Bienville to the Equinipichas (Choctaws living northeast of the mouth of the Mississippi) to whom he also sent a present of a capot, a calumet, beads, and other things proper to give such persons.[3]

This present, the capot, is not an uncommon occurrence apparently, and the same author refers to a present of a "habit rouge" and the calumet of peace.[4]

Father Gravier, who, in 1701, went over the same ground that Father Marquette had traversed in 1673, refers to the calumet and there being one for peace and another for war, the red signifying war. He goes so far as to say that upon presentation of the calumet even enemies will lay down their arms in the heat of combat. He describes the hollow wooden stem of the pipe as being the origin of the name calumet from a corruption of the word chalumeau, because it resembles a pipe or rather a long flute.[5]

That there were exceptions, however, to the sanctity of the calumet

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[1] Baron Lahontan, Some New Voyages into North America, I, p. 36, London, 1703.

[2] Documents Relating to the Colonial History of New York, III, p. 842.

[3] Journal de M. Sanvole, Historical Collections of Louisiana, Pt. 3, p. 225.

[4] Idem, pp. 228, 232.

[5] John Gilmary Shea, Early Voyages Up and Down the Mississippi, Journal of a Voyage of Father Gravier, of the Society of Jesus, from the country of the Illinois to the mouth of the Mississippi, p. 130, Albany, 1861.

of peace is evidenced by Bernard de la Harpe, who records the breaking of the arm of Charles, the Canadian, in January, 1703, by a party of Indians who had presented the calumet, and the same night assassinated his companions.[1] The singing of the song of the calumet was not confined to the natives by any means, for in this they were imitated by the French[2] on more than one occasion.

Du Pratz, in his history of Louisiana, illustrates the manner of dancing the calumet on the Lower Mississippi in 1719 by the Tchitimachas (fig. 173).

He says: "I had an opportunity during this trip to satisfy my curiosity on the subject of the calumet of peace, of which I had heard so much from the old French inhabitants. There having been war with the Tchitimachas (a distinct linguistic stock located west of the mouth of the Mississippi), they asked for peace. A delegation arrived singing the calumet song, and with the calumet moving in rhythm they advanced, keeping time to the sound of the rattle."[3]

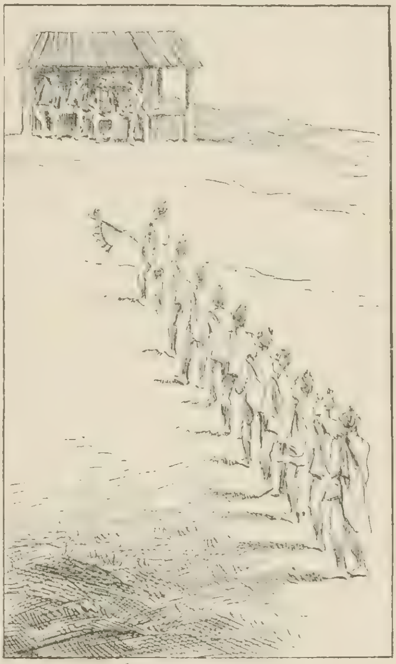

Fig. 173.
CALUMET DANCE.
After Du Pratz.
Histoire de la Louisiane, p. 105.

"The calumet," he says, "is the tube of a pipe at least 1½ feet long, covered with a skin composed of the head and neck of a wood duck, of which the many-colored plumage is exceedingly attractive, and at the end of the tube there is a pipe. At the same end there is fixed a kind of wing of the white eagle, in shape of a quarter circle, and at the end of each feather it is encircled by a hoop dyed a bright red color, while the other end has none."[3] After a brief description of the preliminaries, he says: "The speaker stood up while the assistant filled the pipe, and after smoking it, he dried it, and handed it to Mr. Bienville to do the same; then we all smoked it, after which the old man took the calumet and gave it to Mr. Bienville to keep."[4] On these occasions, he says, "they are dressed in their best, and never fail to hold in their hand a chichicois" (rattle), "which they also move in rhythm."[4] "The war calumet," he says, "is a pipe of the same material and shape excepting the color of the feathers, which are those of an aquatic bird, the flamingo. The

[1] B. F. French, Historical Collections of Louisiana, p. 30, New York, 1851.

[2] John Gilmary Shea, Early Voyages Up and Down the Mississippi. Sainte Cosme's Voyage on the Mississippi, p. 72, Albany, 1861.

[3] Le Page Du Pratz, Histoire de la Louisiane, I, p. 108, Paris, 1758.

[4] Idem, p. 105.

head of the bird is skinned, the feathers being of a whitish gray, which being dyed, only makes a light red, the hoop and tufts being black. The stem of the pipe is covered with the skin of a carancro" (carrion crow?), "as black as a blackbird and as big as a turkey.[1]"

There is difficulty in defining the word "carancro," unless it be a corruption of the English "carrion crow," though probably either the turkey, vulture, or black vulture is intended, as both are common in Louisiana; both are black and both are about the size of a turkey.

Charlevoix, in 1721, among the Onondagas, says there is perhaps no example of an agreement entered into after smoking the calumet ever being violated, but asserts that if it be presented in the midst of a battle by an enemy it may be refused. He describes the war calumet as being all red, or red on one side, and says that from the manner in which the feathers are arranged they know at sight the nation to which it belongs.[2]

Of wampum Charlevoix says that these shells were of two colors, from which the belts were made, and that the red ones were frequently sent when war was intended; and in reference to the red and white colors signifying war or peace, suggests that they have taken the hint from the colors of the English and the French. "It is even said," he remarks, "that we ourselves first introduced it amongst them."[2]

This author's explanation of the calumet differs somewhat from that generally suggested. He says: "The calumet is no less sacred among the Indians than the collar of wampum; it is even, if we believe them, of divine origin, for they maintain it was a present made them by the sun. It is more in use among the southern and western nations than among the eastern and northern, and is more frequently employed for peace than for war. Calumet is a Norman word, being a corruption of chaliorveau, and the calumet of the Indian is properly the stalk of the pipe, but under that name is understood the whole pipe as well as the stalk. The stalk is very long in calumets of ceremony, and the pipe has the shape of our old hammers for arms. It is commonly made of a sort of reddish marble, very easy to work, and found in the country of the Aiouez [Iowas, Sioux], beyond the Mississippi. The stalk is of a light wood, painted with different colors, and adorned with the heads, tails, and feathers of the most beautiful birds, which in all probability is only intended for ornament."[3]

That calumet customs were similar throughout a great part of the north and west there is abundant evidence, and the practice prevailed even as far south as Virginia. Robert Beverly, in 1722, enumerates five things which were always observed in receiving strangers, in order to determine whether they came on a peaceful or on a warlike mission.

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[1] Le Page Du Pratz, Histoire de la Louisiane, I, p. 118, Paris, 1758.

[2] Peter Francis Xavier de Charlevoix, Journal of a Voyage to North America, I, p. 321, London, 1761.

[3] Idem, p. 320.

"First. They take a pipe much larger and bigger than the common tobacco pipe, expressly made for the purpose, with which all towns are provided.

Second. This pipe they always fill before the face of the strangers, and light it.

Third. The chief man of the Indians takes two or three whiffs and hands it to the chief of the strangers.

Fourth. If the strangers refuse it, it is a sign of war.

Fifth. It it be peace, the stranger takes a whiff or two and hands it to the next great man of the town they come to visit; he after taking two or three whiffs gives it back to the next of the strangers, and so on alternately until they have passed it to all persons of note on each side, and then the ceremony is ended."[1]

In New York the calumet was used at a council in Albany, May 30, 1723.[2]

Cadwalader Colden, in 1724, speaks of the calumet being used by the Five Nations, and says it was used by the Indians before they knew anything of the Christians, and is at a loss to know how they were pierced and shaped before they had the use of iron.[3]

Father J. F. Lafitau, whose great work on the American Indians was published in 1724, refers to the Sioux having endeavored to fool a French officer by presenting him a dozen calumets. One of his Indians to whom he showed them called his attention to the fact that one of them was not twisted with hair, as the others were, and had besides engraved on its handle a snake, and assured him it was a sign of treason. But, he says, "they tell me it is a greater sign of war when they paint the handle red between the hairs." The Europeans, he says, "up to the present time, who have traded with the Illinois and the other people of Louisiana have used the calumet and have participated in all its ceremonies in order to obtain liberty to pass in peace in their commercial transactions." He "sees in the custom remains of paganism and a marked idolatry," and thinks "it should be abolished entirely among the Europeans and nations who have embraced or who may want to embrace Christianity."[4]

That the sanctity of the calumet was not always respected there can be no doubt, even along the Mississippi, where instances have been cited of refusal even to communicate with those carrying a calumet. Lafitau says that if in council between ambassadors and the Indians concerning the making of peace the council decides upon war it is a great misfortune for the ambassadors, for the law in that case only protects them as long as the matter is in abeyance, but being negatived they knock them in the head where they are, though they often take honorable leave of them and then send and have them assassinated a few days

[1] History of Virginia, I, p. 157, Petersburg and Richmond, 1722.

[2] Documents relating to the Colonial History of New York, V, p. 695.

[3] The History of the Five Nations, p. 55, note, London, 1724.

[4] J. F. Lafitau, Mœurs des Sauvages Amériqains, II, p. 335, Paris, 1724.

march from the village. He remarks that it is not customary to burn or make slaves of ambassadors, though the Iroquois burned some of those accompanying the Chevalier d'O, whom the Comte de Frontenac had sent to them, and would have burned him if he had not taken refuge among the English. The law of nations, he says, is more respected among the nations living in Louisiana along the borders of the Mississippi, who observe the custom of the calumet, which the Iroquois have not, nor have the natives near Quebec and on the lower St. Lawrence.[1]

Lafitau lived many years among these people, from 1712 on. He studied their character and was thoroughly acquainted with them, though his reference is probably to the dance as a Siouan function rather than that of other tribes, the pipe offering became common eventually between the whites and natives throughout the country and acted as a truce. Lafitau refers to the details of a religious dance witnessed by Le Sieur de Leri among the Caribs about this period, which appears to have been similar to the calumet dance of the Sioux. "These Caribs," he says, "in advancing and jumping forward and retreating, took a stick about 4 or 5 feet long, at the end of which they had the dry herb petun, and lighted it, turning around and blowing the smoke on all the other savages."[2]

Lionel Wafer describes a most peculiar and unique method of smoking in 1680 that was indulged in by the natives of the Isthmus. The dried tobacco leaves were "stripped from the stalk, and laying two or three leaves upon one another they roll all up sideways in a long roll, yet leaving a little hollow; round this they roll other leaves one after another in the same manner, but close and hard, till the roll is as big as one's wrist and 2 or 3 feet in length. Their way of smoking when they are in company together is thus: A boy lights one end of a roll and burns it to a coal, wetting the part next to it to keep it from wasting too fast; the end so lighted he puts into his mouth, and blows the smoke through the whole length of the roll into the face of every one of the company or council, though there be two or three hundred of them. Then they, sitting in their usual posture upon forms, make with their hands held together a kind of funnel around their mouths and noses; into this they receive the smoke as it is blown upon them, snuffing it up greedily and strongly, as long as ever they are able to hold their breath, and seeming to bless themselves as it were with the refreshment it gives them."[3]

To return however to the calumet. One of the early accounts of the locality from whence the red pipestone was derived is recorded by Du Pratz and vouched for by officers of the expedition made by Le Bourgmont to the Padoucas, yet will likely be read with incredulity. "That there was," he says, "a high bluff in which was a mass of red stone flecked with white, like porphyry, with this difference, that this of which

[1] J. F. Lafitau, Mœurs des Sauvages Amériqains, II, p. 314.
[2] Idem, II, p. 136, quoting Leri's Histoire de l'Amérique.
[3] Lionel Wafer, A New Voyage and Description of the Isthmus of America, p. 80, London, 1704.

we speak is almost as soft as tufa. It is covered with another stone which has no merit. The natives who knew its worth endeavored to cut it with blows from their arrows, and when pieces dropped into the water, they found it by diving. When they got a piece large enough from which to make a calumet, they made it by means of a knife and awl. The stone works easily and resists a hot fire."[1]

This description answers correctly the characteristics of catlinite and its bed, which lies between layers of quartzite at Couteau des Prairies. This red stone, often spoken of by early writers as a red marble, has a brilliant color and is susceptible of a high polish, and there is evidence in the primitive burials of a large area that from an early period there was an extensive trade in it. Though there does not appear ever to have been such distribution of other pipes as there was of those made of clay such as were used by the English who, on July 6, 1742, in the meetinghouse in Philadelphia at a council held by Lieut. Governor George Thomas and certain gentlemen with Onontogoes, Caiyoquos, Oneidas, Senecas, Tuscaroros, Shawanoes, Canestogas, etc., gave away 1,000 tobacco pipes, 200 pounds of tobacco, and 100 tobacco tongs, this gift being duplicated for the land on the east side of the Susquehanna River.[2]

The ceremony of intertribal smoking in the manner related is said to have occurred during the governorship of the Hon. George Clinton on July 8, 1751, between the Catawbas and the Six Nations in Albany, New York. "The Catawbas came down from their quarters singing, with their colors pointed to the ground, and having lit their pipes, the king and one more put them in the mouths of the chief sachems of the Six Nations who smoked out of them. The chief sachem of the Senecas lit a pipe and put it in the mouths of each of the Catawbas, who smoked out of it and then he returned it among the Six Nations.[3]

Woodrow Wilson gives a good description of the conditions existing between the French and the English in 1751-1753: "The strength of the French lay in their command of the water courses which flanked the English colonies both north and west, from the Gulf of St. Lawrence to the mouths of the Mississippi. There were French posts at Niagara and Crown Point on Lake Champlain, and English posts were at Oswego and on the Hudson. The English were pressing toward the western mountains and down into Virginia to the Shenandoah Valley; quite three hundred traders went into Ohio every year. Du Quesne established Presque Isle in 1753. Washington, sent by Governor Dinwiddie, met the French at Fort Le Bœuf, warning them to leave the country, and returned January, 1754. The French established Fort Du Quesne in 1754, Washington being defeated at Great Meadows. Braddock made his campaign in 1755 against Du Quesne and was badly defeated."[4]

Sir William Johnson at a meeting with the Six Nations on February 23, 1756, gave them the largest pipe in America, made on purpose, and

[1] Histoire de la Louisiane, I, p. 326.

[2] Cadwallader Colden, History of the Five Nations, Pt. 2, p. 57, London, 1747.

[3] Documents Relating to the Colonial History of New York, VI, p. 724.

[4] Woodrow Wilson, Colonel Washington, Harper's Magazine, March, 1896.

said to them: "Take this pipe to your great council chamber at Onondaga; let it hang there in view, and should you be wavering in your minds at any time, take and smoke out of it, and think of my advice given with it, and you will recover and think properly,"[1] and on July 23, 1756, in the proceedings of a council with "Pondiac" and chiefs of the Ottawas, Pontawattamies, Hurons, and Chippewas, the chiefs being all seated, Sir William Johnson caused Pondiac's pipe to be lighted, which, after being handed around by the interpreter to all present, he addressed them.[2]

"On September 19, of the same year, at Fort Johnson, New York, the Mohawks of both Castles, the Oneidas, the Cayougas, and two Seneca sachems with the River Indians met in council, and sent to acquaint Sir William that they proposed to deliver the message agreed upon on the 18th to the Cherokee deputies. When Sir William came in and all were seated, the four Cherokees were introduced to the council by Captain Montour, and taking seats in four chairs placed purposely for them, Sir William lighted the calumet, or pipe of peace and friendship, and after smoking a whiff presented it to the four Cherokee deputies, holding it to them while each drew a whiff, then the gentlemen present took it and Mr. Montour handed it round to every Indian present. The tobacco from whence it was filled was then put into a bag to be carried home with the calumet by the Cherokees,"[3] as showing the then existing international jealousies. A desire was expressed at this meeting to keep a knowledge of it from the French.

Jonathan Carver, who in 1763 endeavored to cross the continent and to acquaint the world with the geography of the interior of the country and the lands acquired after the peace of 1763, says: "I knew that many obstructions would arise in my scheme from the want of good maps and charts; for the French while they retained their power in North America had taken every artful method to keep all other nations, particularly the English, in ignorance of the concerns of the interior parts of it, and to accomplish this design with greater certainty they had published inaccurate maps and false accounts."[4]

Robert Rogers says: "When they use collars or belts of wampum, it must be a matter of national importance."

He refers also to the customs of the natives, and also to the calumet of peace as being of no less importance in many transactions—"relative to war and peace. The bowl of this pipe is made of a soft red stone, which is easily wrought and hollowed out; the stem is of cane, elder, or some light wood, painted with different colors, and decorated with the heads, tails, and feathers of the most beautiful birds. The use of the calumet is to smoke either tobacco or some bark, leaf, or

[1] Documents Relating to the Colonial History of New York, VII, p. 64.

[2] Idem, II, p. 854.

[3] Idem, VII, p. 327.

[4] Jonathan Carver, Travels through the Interior Parts of North America, p. xxiv, introduction, London, 1781; reprint edition, New York, 1838.

herb, which they often use instead of it, when they enter into an alliance. When they treat of war the whole pipe and ornaments are red. Sometimes it is red only on one side, and by the disposition of the feathers, etc., one acquainted with their customs will know after first sight what the native who presents it intends or desires. Smoking the calumet is also a religious ceremony upon some occasions, and in all treaties is considered as a witness between the parties."[1]

"On July 1, 1765, a Frenchman arrived" in the colony of New York "from the Illinois with a pipe and speech from thence to the Kickapoos and Mosquattamis. * * * Then they spoke on several pipes and belts. Pondiac (Algonquin) gave a large pipe with a belt of wampum tied to it."[2]

In 1766 "the Onondaga speaker lighted a calumet of peace which Sir William (Johnson) left in their hands many years ago for that use, and handed it to the western Indians, after which the speaker, with a bunch of wampum, addressed himself to the western nations."[3] This pipe was probably the same one referred to as presented to the Indians on February 23, 1756.

Carver also describes the calumet and its decorations, but adds nothing to the description of its appearance beyond what has already been set forth. He refers to the different methods employed in decorating the calumet and the fact of the Indians' ability to tell at first sight to what tribe it belongs. He is more explicit, however, in describing the ceremony of the smoke. "The assistant or aid-de-camp of the great warrior, when the chiefs are assembled and seated, fills the pipe with tobacco mixed with herbs, taking care at the same time that no part of it touches the ground. When it is filled he takes a coal that is thoroughly kindled from a fire which is generally kept burning in the midst of the assembly and places it on the tobacco." Having done so, "he presents it to the hereditary chief, who, having taken two or three whiffs, blows the smoke from his mouth, first toward heaven and then around him upon the ground."[4] It is then presented to the others of the council by the bearer, and they only touch it with their lips.

Referring to the Southern tribes, the Talapouches and Alibamons, Bossu, in 1768, speaking of their meeting persons, says when you land they give you the hand in presenting the calumet, and when you have smoked they ask the subject of your travels.[5]

The head priest, he says, "with a dignified step, daily went forward before the sun rose with the calumet in his hand and blew the first mouthful of smoke toward it."[6] The equipment of these Indians for war was of the simplest character—"a bearskin for a bed, a beef [buffalo?] skin

[1] Robert Rogers, A Concise Account of North America, pp. 223, 224, London, 1765.

[2] Documents Relating to the Colonial History of New York, VII, pp. 780, 782, 783.

[3] Idem, VII, p. 863.

[4] Jonathan Carver, Travels through the Interior Parts of North America, p. 224, New York, 1838, from the third London edition.

[5] M. Bossu, Nouveau Voyages aux Indes Occidentales, II, p. 17, Paris, 1768.

[6] Idem, I, p. 43.

for covering, a wild-cat skin to hold the calumet, and a club or small ax for making their cabins."[1]

The "AkançAs" received Bossu with the calumet dance, first having tattooed him; he thereafter smoked the calumet[2] as though tattooing was a prerequisite or initiation to the pipe ceremony. In referring to the drowning of several soldiers he says he also would have met the same fate had it not have been for a generous "AkançAs," who, without fearing the rigor of the weather, jumped into the water and pulled him out by his capot, "a linen garment of travelers resembling a capuchon."[3]

One can with difficulty refrain from laughing at Bossu's description of the function of the calumet dance given by the Missouri Indians after their return from a raid to the southwest, where they had literally cleaned out a Spanish mission and probably killed all those guarding it. He says: "They brought here the ornaments of the chapel, in which they were dressed. The chief wore over his skin the best chasuble, having the patin hanging from his neck pierced by a nail and answering the purpose of a gorget; he marched at the head of the procession, having on his head a feather bonnet and pair of horns; he was followed by others wearing stoles and maniples around their necks. Following these were three or four savages clothed in surplices. The acolytes, contrary to usage, marched at the tail of the procession, and not finding themselves sufficiently decorated, danced forward in step, holding either a cross or a chandelier in their hands. Not appreciating the value of sacred vessels, they had hung a chalice at a horse's neck, on the principle of a bell. Imagine the ridiculous spectacle witnessed by the order of this queer procession arriving at the house of M. Boisbriant, lieutenant of the King, marching in step, with the great calumet of peace solemnly carried in front."[4]

Albert James Pickett informs us that "the grand chief of the Natchez bore the name of the sun. Every morning as soon as that luminary appeared he stood at the door of his cabin, turned his face toward the east and bowed three times, at the same time prostrating himself to the ground. A pipe, which was never used but upon this occasion, was then handed to him, from which he puffed smoke, first toward the sun and then toward the other three quarters of the world."[5]

Ulloa says that among the natives of Peru the use of tobacco was very moderate, and that the people of the more elevated regions do not smoke. In some of the lower parts of the country, where the natives do use it, he says, "It is astonishing that tobacco, a product of these countries, has not a more extended use among the Indians, considering it has become so necessary in Europe."[6]

He thinks that the offering of the pipe to visitors was similar to that indulged in among Orientals, accompanying it with coffee and other drinks, which were similar to the Indian customs of hospitality with

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[1] M. Bossu, Nouveau Voyages aux Indes Occidentales, I, p. 118, Paris, 1768.

[2] Idem, I, pp. 110, 122. [3] Idem, I, p. 130. [4] Idem, I, p. 176.

[5] A History of Alabama, and incidentally of Georgia and Mississippi, I, p. 130, Charleston, 1851, quoting Charlevoix.

[6] Memoirs Philosophiques, p. 59, Paris, 1787.

the pipe, and indicates a common origin, no matter how far back from our time. The shape of pipe bowls and of stems also differ from the shape of the European pipe. He thinks the use of tobacco was not introduced into Europe by the discovery of America.[1]

Among the Southern Indians Pickett speaks of the "council house where the inhabitants were accustomed to take the black drink. When the drinking began tobacco contained in pouches made from the skins of the wild-cat, otter, bear, or rattlesnake was distributed among the assembly, together with pipes, and a general smoking began. The king began first with a few whiffs from the great pipe, blowing it ceremoniously first toward the sun, next toward the four cardinal points, and then toward the white audience; then the attendants passed the pipe to others of distinction."[2]

We see here a reference to the general aboriginal belief in the six quarters of the universe, the above and the below, in addition to the four cardinal points, or the four winds, all being equally important, according to primitive ideas. William Bartram refers to smoking with a chief a pipe, the "stem of which was about 4 feet long and was sheathed in a beautiful speckled snake's skin, adorned with feathers and strings of wampum."[3]

An early reference to the calumet custom is the quaint description given by John Filson in his History of Kentucky, as translated by Parrand, of a meeting held at Fort St. Vincent, April 15, 1784, between Thomas J. Dalton, who said to the Piankashaws, "The white men—Americans, French, Spanish, Dutch, and English—smoke the pipe of peace; the tomahawk is buried, and we are now all friends. In eighteen days I quit the Wabash to see my big chief at the falls of the Ohio. Here is tobacco that I give you; smoke it, and consider what you will do." Then he gave a collar of wampum, blue and white, and said, "Piankashaw, talk; talk to the Americans." The chief of the Piankashaws said: "We accept your wampum belt. We accepted the tomahawk of the English. We smoke, as brothers, the peace pipe which we give you. See, O father, the pipe which gives us joy. Smoke it yourself. Our warriors are pleased that we give it to you. We smoke your pipe." He closes his oration in a somewhat startling manner, however, saying, "We ask of you a little taste of your milk, that our warriors may see it comes from your breast. We are born and raised in the woods and can never learn to make rum. God made the white man master of the world. They make everything; and all of us love rum."[4]

In 1789 Georg Heinrich Loskiel speaks of the peace pipe, or calumet, as it was called by the French, as having a head of red marble, the red of which is a sign of blood, which they would not send as a peace emblem, but cover it over with white clay or chalk. This pipe was 6 or

[1] Memoirs Philosophiques, p. 59.

[2] A History of Alabama, I, p. 102, quoting Bartram.

[3] William Bartram, Travels through North and South Carolina, p. 319, Dublin, 1793.

[4] Histoire de Kentucke, p. 101, translated from English of John Filson, by M. Parrand, Paris, 1785.

8 inches long and 3 inches high, its stem being 4 feet long, with a pretty band wound around it, with porcupine quills and white corals worked into the band, in which latter work the women endeavor to show their skill.[1] The people of whom he spoke were the Delawares and Iroquois.

In the extreme northwest of the continent, Mackenzie, in 1792, gave the natives of the Peace River a pipe as a token of peace, just as all his predecessors had done throughout the continent for one hundred and fifty or more years.[2] He also informs us that among the Crees even the funeral rights begin with smoking, as do all other solemn ceremonies, and conclude with a feast.[3]

Mackenzie says a contract which is solemnized by the ceremony of smoking never fails of being faithfully fulfilled, and if a person previous to going on a journey leaves the sacred stem as a pledge of his return, no consideration whatever will prevent him executing his engagement.[4]

One of the most careful and particular accounts of Indian smoking which has come down to us is that of Mackenzie describing its practice among the Kinsteneaux. He says: "The owner of the dwelling opens his medicine bag, which contains a piece of Brazil tobacco, several roots and simples, which are in great estimation, and a pipe. These articles being exposed and the stem resting upon two forks, as it must not touch the ground, the master of the lodge sends for the person he most esteems, who sits down opposite to him. The pipe is then filled and fixed to the stem. A pair of wooden pincers are provided to put the fire in the pipe, and a double-pointed pin to empty it of the remains of tobacco which is not consumed. This arrangement being made, the men assemble and sometimes the women are allowed to be humble spectators, while the most religious awe and solemnity pervades the whole. The assistant takes up the pipe and presents it to the officiating person, who receives it standing, and holds it between both his hands. He then turns himself to the east and draws a few whiffs, which he blows to that point; the same ceremony he observes to the other three quarters, with his eyes directed upward through the whole of it; he holds the stem about the middle, between the three first fingers of both hands, and raising them upon a line with his forehead he swings it three times around with the sun, when, after pointing it and balancing it in various directions, he reposes it on the forks. The assistant then takes up the pipe and holds it to the north of the officiating person, who, after smoking three whiffs out of it, utters a short prayer, and then goes around with it, taking his course from the east to west, to every person present, who individually says something to him on the occasion, and thus the pipe is generally smoked out. After turning it three or four times around his head he drops it downward and replaces it in its original situation."[5]

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[1] Georg Heinrich Loskiel, Geschichte der Mission der Evangelischen Brüder, p. 202, Barby, 1789.

[2] Alexander Mackenzie, Voyage from Montreal through the Continent of North America, p. 124.

[3] Idem, p. xciv. [4] Idem, p. xcviii. [5] Idem, p. xcvii.

Lewis and Clarke, in 1804, in their expedition up the Missouri after the acquisition of Louisiana, record a peculiar custom among the Shoshones, who take off their moccasins before smoking with strangers.[1] These officers were the first ones who presented the flag as an emblem of peace to this tribe.[2] The leaders of this expedition in their journey up the Missouri smoked the pipe of peace with the Tetons (Sioux), and in describing the pipe raised on forked sticks, say: "The down of swan was scattered under it. They first pointed the pipe toward heaven and then to the four quarters of the globe, then to the earth, made a short speech, lighted the pipe, and presented it to us."[3] They feasted with the Indians and describe their meals, which were scant at times, though dog appears to have been a popular and common dish during a great part of the journey.

Sir John Franklin, on a journey to the Polar Sea in 1820, refers to the Cree customs being similar to those recounted of them by Lewis and Clarke, though he says the bearberry was mixed with tobacco: the one smoking passing the pipe to his left-hand neighbor, and when it reached Franklin and his interpreter who were seated at the door, they were requested to keep the head of the calumet within the threshold.[4]

John D. Hunter, who lived many years as a prisoner among the Kickapoo who had captured him, and who subsequently lived with the Kansas and the Osages, refers to the men often amusing themselves by "making bowls and pipes of clay for their individual use, which are burned."[5] "The eldest person always enters a council lodge first, and is followed by the other counselors much according to seniority in the most perfect order. They then seat themselves cross-legged on mats, which are arranged circularly around the lodge for the purpose. The chief then lights the national pipe, takes three whiffs, passes it after smoking to the next greatest person present, and then it is passed around in the midst of the most perfect silence."[6] If embassies arrive they are given the most honorable position in the lodge, and after the ceremony of smoking they unfold their mission.[7]

The Rev. J. Owen Dorsey records an act of worship among the Sioux which, he says, is of daily occurrence when one is about to smoke his pipe. "He looks to the sky and says 'Wakanta, here is tobacco.' Then he puffs a mouthful of smoke up to the sky, after which he smokes as he pleases." They also make offerings of tobacco by throwing a small quantity in the fire.[8] Mr. Dorsey refers to the Shoshoni chief with whom Captain Lewis smoked, lighting his pipe of transparent

[1] Expedition to the Rocky Mountains, I, p. 364, Philadelphia, 1814.

[2] Idem, p. 365. [3] Idem, p. 84.

[4] John Franklin, Narrative of a Journey to the Shores of the Polar Sea in the years 1820, 1821, 1822, p. 68, Philadelphia, 1824.

[5] Manners and Customs of Several Indian Tribes located west of the Mississippi, p. 98, Philadelphia, 1823.

[6] Idem, p. 320. [7] Idem, p. 326.

[8] A Study of Siouan Cults, Eleventh Annual Report of the Bureau of Ethnology, 1894, p. 425.

green stone.[1] They smoked towards the invoked object and placed gifts of killickinnick upon it.[2] They presented the pipe with the mouthpiece toward the power invoked. The Omaha and Ponka used to hold the pipe in six directions while smoking toward the four winds, the ground, and the upper world.[1]

Certain persons have care of each the peace and the war pipe among the Omaha, and there are others who are designated to light the pipe. Certain words must at times be used in taking out the pipes; if not followed, misfortune overtakes the delinquent. If the proper parties are not present ceremonies must often be delayed. To learn the laws of the pipe takes four days.[3]

The importance of the presentation of the pipe with all due ceremony extends among the Omaha to the buffalo or other game, according to Stephen H. Long, who says: "The party having approached as near the herd as they suppose the animals will permit without taking alarm, they halt to give the pipe bearer an opportunity to perform the ceremony of smoking, which is considered necessary to their success. He lights his pipe and remains a short time with his head inclined. The stem of the pipe extends toward the herd. He then smokes and puffs the smoke toward the bisons, toward the heavens, the earth, and finally to the cardinal points successively. These last are designated by the terms sunrise, sunset, cold country, and warm country, or they designate them collectively by the phrase of the four winds, Ta-da-sa-ga-to-ba."[4]

The pipes are cut, he says, from the red, indurated clay which they procure from the pipestone branch of the Sioux River, the mass being readily cut with a common knife.[5]

One of the most minute descriptions of the calumet dance which the writer is conversant with, is that of Major Stephen H. Long, referring to the Omaha who belong to the great Siouan family. He says:

> The calumet dance, Nin-ne-na-ba-wong, is a favorite dance. It is usually performed by two individuals, in honor and in the presence of one of their own or of a neighboring nation in the expectation of receiving presents in return. A person who intends to perform this dance sends a messenger, bearing a small skin containing tobacco to fill a pipe, to the individual whom he intends to honor. If the proposed compliment should not be acceptable, it is refused in the most courteous manner, with excuses based upon poverty and with many thanks for the honor intended. If, on the contrary, the tobacco should be accepted and smoked, the act shows that the visit also will be acceptable, and a time is fixed for the performance of the ceremony. At the appointed time the dancers, with two selected companions, repair to the place of their destination and are invited into the lodge of the person addressed. After a short time a calumet is placed upon a forked support, which is driven into the soil

[1] Eleventh Annual Report of the Bureau of Ethnology, p. 375.

[2] Idem, p. 373.

[3] J. Owen Dorsey, Omaha Sociology, Third Annual Report of the Bureau of Ethnology, p. 221.

[4] Stephen H. Long, Expedition from Pittsburgh to the Rocky Mountains, I, p. 208, Philadelphia, 1823.

[5] Idem, I, p. 332.

in the back part of the lodge. Notice is then given to the bearer of the calumet respecting the time when it will be convenient for the dance to take place. The bearer of the calumet is now considered as the father, and addresses the individual whom he is about to honor by the title of son, presenting him with some valuable articles, such as a gun, kettle, blankets, clothing, and ornaments for his youngest child, who is destined to represent the father, or the adopted son, at the ensuing ceremony.

At sunset the calumet is taken from the forked stick, or support, enveloped like an infant in swaddling clothes, and placed carefully in a bed prepared for its reception; a lullaby is then sung, accompanied by the music of the rattle, for its quiet repose. On the following morning it is awakened by a song, with the same music, and again consigned to its forked support. The appointed day having arrived, a space of sufficient diameter is inclosed by a screen of skins for the dance; a post is fixed in the earth, near the entrance to the area. Around this area the principal men of the nation seat themselves; the adopted son leads in his youthful representative, and the two dancers, decorated with paint and entirely destitute of clothing, with the exception of the breech-cloth, commence the dance. They are each provided with a decorated calumet stem and a rattle of dried skin or a gourd, containing pebbles, with which to keep time with the music of the gong and to the vocal chanting of the musicians of the village. They dance in the ordinary manner of the Indians and pass backward and forward between the entrance and back part of the area, endeavoring to exhibit as much agility as possible in their movements, throwing themselves into a great variety of attitudes, imitative of the actions of the war eagle, preserving at the same time a constant waving motion, with the calumet in the left hand and agitating the gourd in the right, more or less vehemently, agreeably to the music. Warriors and braves will now bring forth presents of horses, guns, etc. The bridle of the horse is attached to the post by the donor, who receives the thanks of an old crier stationed there to perform that duty. The music now ceases while the donor strikes the post and recounts his martial deeds, and boasts of the presents which he has made at different times on similar occasions. Sometimes during a ceremony a warrior will take the gong from the performer and strike upon it as many times as he has achieved brave and generous actions; he then sits down, and no one must dare touch it but such as can strike it more frequently than the first; if this is done the gong is returned to the performer. The calumet dance sometimes continues two or three days, but each night the calumet is consigned to its repose in the bed with the same ceremonies as the first night. When all the presents have been made which the dancers have reason to expect, they depart immediately with them to their own nation or lodge. Instead of striking the post the donors sometimes strike lightly upon the persons of the dancers. The presents made at these dances are sometimes quite considerable. Ong patunga once danced the calumet to Tarrarecawaho, the grand Pawnee chief, and received from him between eighty and ninety horses. The Pawnees are, indeed, distinguished for their liberality and dexterity at this ceremony. They gave one hundred and forty last autumn to the Otoes who performed this dance at their village, and gave so much satisfaction to many individuals of this nation as to receive extraordinary presents from them. On this occasion one person, in the warmth of his feelings, brought forth his child and presented it to them as the most precious gift in his power to bestow. The Pawnees accepted this gift, but on their departure they returned the child to its parents, accompanied by the present of a fine horse, upon which it was mounted.[1]

Maj. J. W. Powell informs the writer that the Shoshonian family, many of the Pueblos, Navajos, Apaches, and Sioux, in smoking, pass

[1] Stephen H. Long, Expedition from Pittsburgh to the Rocky Mountains, I, p. 332, Philadelphia, 1823.

the pipe to the left of the one smoking; at times it is passed from the smoker back to the officiating chief, when he passes it to his right, but to the left of the smoker. The significance is that it must go with the sun.

Maximilian von Wied, in referring to the Blackfeet, says: "If you visit an Indian in his tent, the pipe is immediately taken, which in company is generally circulated to the left. The owner of the house often blows the smoke to the sun, then to the earth. One takes a few whiffs and passes it on. The smoke is drawn right into the lungs. The last smoker never passes it back, but gives it to the one sitting in the row opposite to him and it goes again to the left."[1]

Father P. J. De Smet refers to the calumet customs as they existed in 1841 among the "Pottawatomies or Northern Nations (Algonquins), its sacredness, its colors, feathers, and always being part of all religious ceremonies."[2]

Catlin, in one of his descriptions, says the pipe is ornamented with the quills of the war eagle and wrapped in many bandages, and is only used in making treaties.[3] He says, concerning the smoking of the Sioux: "In their native state they are excessive smokers and would seem to be smoking one-half of their lives. There are many weeds and leaves and barks of trees which the Indians dry and pulverize and carry in pouches and smoke to great excess, and in several of the languages when thus prepared is called k'nick k'neck."[4]

Miss Alice Fletcher informs the writer that among the Dakotas and Sioux the pipe is an implement of ceremony, and so employed; and that for all ceremony the pipe is prominent. The Moki, Dr. J. W. Fewkes informs the writer, use different herbs in their ceremonies, at times as many as six. Having given a chief some spruce from near Santa Fe, New Mexico, the latter said it was good for the pipe, because it was the most eastern place he knew, and they desired herbs from as great distances as possible from each of the four world quarters, as it made the best medicine. Ordinarily they smoke *Nicotiana attenuata*, but in formal smoking they use no manufactured American tobacco. The pipe bearer lights the pipe with a corncob and carries it in both hands with the bowl down and away from him; he hands it to the chief, who smokes six whiffs to the north, west, south, and east, then up and down on the altar. The chief then hands the pipe to the one on the left. The last man in the row hands it back to the pipe bearer. If there is a second line of persons on the opposite side of the altar, the pipe bearer smokes and passes it to his right; but it must be another pipe. The above refers to a ceremonial smoke. There is one head chief; the pipe

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[1] Maximilian von Wied, Reise in das Innere Nord Amerika, I, p. 570, Coblenz, 1839.

[2] A Narrative of a Year's Residence Among the Indian Tribes of the Rocky Mountains, p. 157, Philadelphia, 1843.

[3] George Catlin, Letters and Notes on the Manners and Customs of the North American Indians, I, p. 235, New York, 1844.

[4] Idem, I, p. 234.

bearer is the next to this chief in dignity. The pipe used in the first eight songs of the sixteen-song dance is of the rectangular character, and appears to be of no special significance, but in the middle of the ceremony, after the eighth song has been sung, the pipe bearer hands a lighted coal to the chief in response to his call, who then puts the coal in a long, straight, conical pipe holding six herbs; placing the big end in his mouth, blows six puffs between the ears of a stone fetish of a mountain lion. No one else smokes this pipe, which is sacred.

The same sacred character, apparently, is attributed to the pipe of ceremony by all the pueblo people as is given to it by the Moki, who again, at the great dance of the winter solstice, which lasts from four to nine days and nights, used the tubular pipe, as they probably do in all ceremonious dances; and in this veneration of the implement their views appear to accord with those of all other Indians.

The conclusion is warranted that the general ceremony of smoking was similar at points far distant from each other; as, for example, from southern Virginia to the country of the Iroquois, from the mouths of the Mississippi to the Wisconsin River, and through a large part of New Mexico, which would indicate a great antiquity when we consider the constant state of war in which the American Indian appears to have been engaged.

CATLINITE AND SIOUAN TYPES.

Beginning with the earliest records of the North American Indians, continuously to recent times, references are made to pipes of red marble, red stone, and red indurated clay, which there is every reason to infer related to the stone now universally known as "catlinite," named after Mr. George Catlin, who lived many years among the Indians, painting their portraits in various costumes of peace and war, as they appeared on their hunting excursions and in their games, as well as in following their ordinary everyday vocations. These catlinite pipes have been found over a wide area, in Indian graves and of several forms, though the typical pipe of this material is the well-known rectangular pipe of the Sioux, those of other forms probably being comparatively modern. Though the material has been so long known and under so many different names, and such wonderful stories have been told of it, the exact locality of the quarries from whence it is derived has been known scarcely fifty years. It is near the town of Pipestone, in southwestern Minnesota. These quarries have quite recently been visited and most carefully surveyed and inspected by Prof. W. H. Holmes, who brought to the U. S. National Museum a section of the material, showing its location and structure in the bed. It is an indurated clay, forming a stratum about 12 inches thick, lying between beds of quartzite. It is of markedly laminated character, scarcely 2 inches of which is of sufficient thickness and suitable for carving pipes. The

ancient pits from which this pipestone has been taken extend for a distance of three-quarters of a mile, the older pits varying from 20 to 40 feet in width and from 4 to 10 feet deep, almost all of them now being partly filled with water. The more recent pits are somewhat deeper, owing to their not having had time to fill in from the effects of seasonal changes. The dumps all over the edges of this ledge where refuse material has been thrown are from 18 inches to 4 feet high. The pits may be numbered by the hundreds. Upon removing the soil in many of them Professor Holmes found notched stone sledges of quartzite pebble and numberless spheroidal hand-chipping hammers used in the quarrying and dressing process through which the material went to make it suitable for final dressing. The quarries are still visited by the Sioux, who annually travel 200 miles or more from their reservation to obtain the material to make into pipes. In one of the ancient pits Professor Holmes found indications of the burial of horses and cattle, and near the quarries are several low burial mounds from 20 to 40 or more feet in diameter, and scattered near the pits are numerous lodge sites, indicated by circular or oblong depressions.[1]

While little appears to be positively known concerning the length of time during which the quarries have been worked, there can be little doubt that they have been in use from a period prior to the advent of the French on the Mississippi. The locality of these quarries is in the territory dominated by the Sioux, and they alone appear from the earliest times to have had control of the "pipestone" of which the typical Sioux pipe is yet made, and little reliance can be placed in the statement of its ever having been a neutral site. Large blocks of the quartz have been sledged off and thrown upon the various dumps along the outcrop, leaving the catlinite, where it is of sufficient density, to be worked into any necessary objects of ornament. There are some large bowlders in the immediate vicinity of the quarries, and upon many of them are visible aboriginal paintings and drawings of both animate and inanimate figures.

Catlinite has by some writers been said to be soft when taken from the quarries and to become harder on exposure to the atmosphere; but the writer's experience in working this stone would indicate that the difference in working fresh or dry stone is insignificant, as pieces which have dried for years are yet nearly as soft as commercial soapstone. Catlinite is quite a soft indurated clay, slightly harder than soapstone; easily cut with a steel knife, or scraped by means of sharp-edged tools of stone or shell, or ground by stone or sand into any desired shape; and by pecking with a stone hammer this material may be formed with perfect ease into any shape, provided care be taken not to strike the blow in the plane of its lamination, along which the cleavage is decidedly pronounced, and its thin lamellar structure becomes distinct and apt to fracture in thin sheets. At any angle to this cleavage plane, however, the stone resists quite severe blows of the hammer

[1] W. H. Holmes, Proceedings, American Association for the Advancement of Science, 1892, XLI, p. 277.

without injury to the block upon which the blow is given other than to cause spalls or pits to fly from each blow. Catlinite may, of course, be sawed, a blade of stone answering the purpose satisfactorily; but the work was, naturally, made much easier with iron tools. The thickest layer of the stone is about the middle of the vein, from which, while only 2 inches thick at most, plates of this thickness may be obtained of almost any size. In boring this stone a jasper or quartzite drill point answers quite well. A wood shaft used with dry sand is equally serviceable. If the sand used in drilling is moistened it prevents the fresh sand falling to the bottom of the drill hole to replace those crystals which have been ground into powder, while if the sand be covered with water the powdered material floats to the top until thoroughly saturated; but the binding by which the drill point is held in position would be loosened if once wet, for the wooden point of the shaft would swell from the same cause, and the worn-off material would pack and retard work by forming a crust. If the sand or even the shaft be damp the swelling of the wood and packing of the dust is equally objectionable. Any stone which may be fractured so as to have a sharp edge answers as a tool with which to scrape the pipestone into shape; the harder the stone, of course, the longer its edge would hold without resharpening. The easiest primitive process of sawing would be to use a stone blade and dry sand until iron tools came into use, though a blade of copper would answer almost equally as well. To grind a smooth surface a gritty sandstone would be used—a coarse one first and finer one later. Any water-washed stone with sand would give a surface as smooth as that of any of the ancient pipes, polishing appearing to be quite a modern treatment, and seldom seen in catlinite pipes, unless made within the last fifty years. A pebble smooths the surface according to the fineness of its texture. Wood ashes gives a good surface and a hard bone is also excellent, acting as a burnisher, for this pipe stone is susceptible of taking a high polish, though those pipes of this material of purely Indian origin are seldom if ever polished more than could be done with any ordinary water-washed pebble. The difference in time requisite to make a pipe from stone fresh from the quarry or from dry stone would, in the writer's opinion, be too insignificant to be appreciable, and the most elaborate pipe of the Siouan type, stone tools being used in working it, could scarcely have required a day to complete.

Primitive catlinite pipes, as stated, have been entirely without ornamentation, though the more recent examples are often most elaborately carved or have their surfaces inlaid with neat figures cut into the stone and filled in with sheet lead, the whole surface being subsequently rubbed to a uniform smoothness, the contrast of the gray of the lead and the Indian red of the stone producing a most pleasing effect. The color of catlinite varies from dark red to light pink, and specimens are in the U. S. National Museum collection of mottled pink and white. Where the glazed surface is encountered, as it not unfrequently is, there is usually evidence of modern manipulation. Much

of the romance of the Indian is connected with this pipe stone, supposed to have been presented to him by the Manito, and to have also sacred, valuable, and mysterious properties, its significance of peace or war all being themes fruitful of praise of this handsome stone, which certainly answers admirably for pipe material; though it is highly probable that this peculiar significance of the red and white color standing for peace or war was a modern attribute attached to the pipe because of the colors of the French and English flags. Longfellow, in the song of Hiawatha, draws a pretty picture of the quarry, of the pipe, its stem, and the material smoked:

On the Mountains of the Prairie,
On the great Red Pipe-stone Quarry,
Gitche Manito, the mighty,

* * * * *

From the red stone of the quarry
With his hand he broke a fragment,
Moulded it into a pipe-head,
Shaped and fashioned it with figures·
From the margin of the river
Took a long reed for a pipe-stem,
With its dark green leaves upon it;
Filled the pipe with bark of willow,
With the bark of the red willow;

* * * * *

Break the red stone from this quarry,
Mould and make it into Peace-Pipes,
Take the reeds that grow beside you,
Deck them with your brightest feathers,
Smoke the Calumet together,
And as brothers live henceforward!

The process of making pipes by the Sioux is thus described by Mr. Charles H. Bennett, of Pipestone City, Minnesota, as quoted by Dr. E. A. Barber: "A piece of the rock is selected from the best portion of the vein, and the Indian sculptor, with an old piece of hoop iron, or a broken knife blade which he has picked up, fashions the block roughly into the desired form. Then slowly and tediously, with the same tools, he bores out the bowl and the hole in the stem before carving the exterior, so that if in the process of boring the stem should be split no labor would be lost. After this is accomplished he shapes the surface into any design which he may have in view. This work often occupies weeks before it is completed, after which the carving is polished by rubbing it with grease or oils in the palms of the hands."[1]

Dr. Barber refers to catlinite being found at several places in Dakota, Minnesota, and Wisconsin.[2]

Catlin supposed the red steatite or pipe stone to be all traceable to

[1] E. A. Barber, Catlinite, American Naturalist, July, 1883, p. 750.
[2] Idem, p. 763.

one source, and that near the mouth of the Teton River on the upper Missouri, at that date yet unvisited except by the Indians, "given them by the Great Spirit for pipes, and forbidden to be used for anything else."

Catlin also describes the manufacture of pipes, saying: "The Indians shape out the bowls of these pipes from solid stone, which is not quite as hard as marble, with nothing but a knife. The stone, which is of a cherry-red, admits of a beautiful polish, and the Indian makes the hole in the bowl of the pipe by drilling into it a hard stick, shaped to the desired size, with a quantity of sharp sand and water kept constantly in the hole, subjecting him, therefore, to a very great labour and the necessity of much patience."[1]

He says: "The shafts or stems of these pipes are from 2 to 4 feet long, sometimes round, but most generally flat, of an inch or two in breadth, and wound half their length or more with braids of porcupine quills, and often ornamented with the beak and tufts from the woodpecker's head, with ermine skins and long red hair, dyed from white horse hair or the white buffalo's tail. The stems of these pipes are carved in many ingenious forms and in all cases they are perforated through the center, quite staggering the enlightened world to guess how the holes have been bored through them, until it is simply and briefly explained that the stems are uniformly made of the stalk of the young ash, which usually grows straight and has a small pith through the center, which is usually burned out with a hot wire, or a piece of hard wood by a much slower process."[2]

Catlin also refers to the tradition that quarries were on neutral territory, where even enemies would lay aside their arms and seek the material and smoke in peace, until finally the Sioux broke the truce.

Henry R. Schoolcraft says this stone is "fissile and easily cut or ground, by trituration with harder substances, to any figure. It bears a dull polish, which was produced by rubbing the surface with the equisitum, or rush, which has a silicious, gritty surface."[3]

Peter Kalm, early in the eighteenth century, referring to this subject, says: "The old tobacco pipes of the Indians are likewise made of clay, or pot stone, or serpentine stone. The first sort are shaped like our tobacco pipes, though much coarser and not so well made. The tube is thick and short, hardly an inch long, but sometimes as long as a finger. Their color comes nearest to that of our tobacco pipes which have been long used. Their tobacco pipes of pot stones are made of the same stone as their kettles. Some of them are pretty well made, though they had neither iron nor steel. But besides these kinds of tobacco pipes, we find another sort of pipe, which are made with great

[1] George Catlin, Letters and Notes on the Manners and Customs of the North American Indians, I, p. 234, New York, 1844.

[2] Idem, I, p. 235.

[3] Henry R. Schoolcraft, Notes on the Iroquois, p. 237, Albany, 1847.

ingenuity, of a very fine, red pot stone or a kind of serpentine marble. They are very scarce and seldom made use of by any other than the Indian sachems or elders. The fine red stone of which these pipes are made is likewise very scarce, and is found only in the country of those Indians who are called Ingouez, and who, according to Father Charlevoix, live on the other side of the river Mississippi. The Indians themselves commonly value a pipe of this kind as much as a piece of silver of the same size, and sometimes they make it still dearer. Of the same kind of stone commonly consists their pipe of peace, which the French call Calumet de Paix, and which they make use of in their treaties of peace and their alliances."[1]

There is little doubt that the red stone here referred to was catlinite.

Hunter, referring to the Kickapoo, Kansas, and Osage tribes, says: "They also make bowls and pipes of a kind of indurated bole and of compact sand and limestone, which are excavated and reduced to form by means of friction with harder substances, and the intervention of sand and water. They generally ornament them with some figure characteristic of the owner's name, as, for instance, with that of a buffalo, elk, bear, tortoise, serpent, etc., according to the circumstance or caprice that has given rise to its assumption."[2]

Barber refers to catlinite being found in Indian graves in New York, and in Georgia from a village site, points 1,200 miles from the quarry, and revealing the vast distances over which some intercommunication extended.[3]

Specimens of this stone have been supposed to be found in an Indian burial place in Santa Barbara County, California, in the shape of tubes about 5 inches long by a diameter of 1 inch,[4] though this supposition is evidently a mistaken one.

Specimens coming under the writer's notice from California of the character referred to are made from a light pink indurated clay, which is, however, mixed with sand and much softer than the catlinite, though there is similarity in the color of the two stones. The California specimens have certainly been made from a local source of supply.

William McAdams refers to a curved base "mound pipe" of catlinite found in a mound on the Illinois River bottom 15 miles from its mouth, where at a depth of 16 feet from the surface they found a basin of clay filled with clean white sand and a beautiful pipe of mottled catlinite.[5] This implement was found associated with sea shells and objects of copper. A present is referred to as early as 1693, made by the western nations to the Iroquois, of "a calumet of red stone of extraordinary beauty and size."[6]

The Indian is by no means the only one who worked the catlinite

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[1] Peter Kalm, Travels into North America, II, p. 43, London, 1771.

[2] John D. Hunter, Manners and Customs of Several Indian Tribes located West of the Mississippi, p. 298, Philadelphia, 1823.

[3] E. A. Barber, Catlinite, American Naturalist, July, 1883, p. 763.

[4] Stephen Bowers, American Naturalist, XVII, p. 990.

[5] William McAdams, Mounds of the Mississippi Bottom, Illinois, Smithsonian Report, 1882, p. 684.

[6] Documents Relating to the Colonial History of New York, X, p. 644.

into pipes, for Dr. F. V. Hayden referred to the Northwest Fur Company having manufactured nearly two thousand pipes during two years between 1865 and 1868 and traded them to the Indians on the Upper Missouri, which fact will, he thinks, throw a suspicion on Indian pipes in the future.[1]

From the time John Smith's people asked permission of Powhatan to pass through his country to obtain stones from which to make axes to the present time the trade with the natives has consisted largely in those things made in imitation of aboriginal implements by the whites for Indian trade. This trade was most valuable and returned enormous profits on small capital invested, and its particulars would not be made public for fear of having the field too crowded. Notwithstanding a known large production of "wampum" and of "roanoke" by the whites, references to its manufacture are unusual in the early records though it was not only an article of trade but of currency as well.

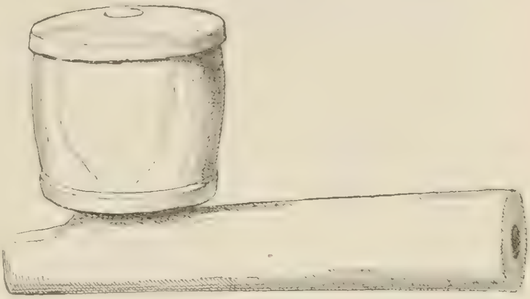

Fig. 174.

SIOUAN CATLINITE PIPE.

Cat. No. 12268, U.S.N.M. Collected by George Catlin.

When pipes are found with figures of men or beasts carved on them it is observed that those of a given type have the figures on them all facing in a particular direction, either to or from the smoker.

Fig. 174 is one of the catlinite pipes brought from the country west of the Mississippi by Mr. George Catlin, which is $5\frac{7}{8}$ inches long with a height of $3\frac{1}{4}$ inches, being made from an unusually heavy piece of stone $2\frac{1}{4}$ inches thick, the bowl and stem holes being each three-eighths of an inch in diameter, the whole surface of the stone being highly polished. The stems of these pipes are round or square, while the projections in front of the bowls are usually square or octagonal, decreasing usually toward the end: the bowls vary in form, some being square, others cylindrical or even spheroidal, and at times are carved with some excellence and have figures upon the stems, which usually face the smoker, and where this practice is departed from there is likelihood of its being done for the benefit, if

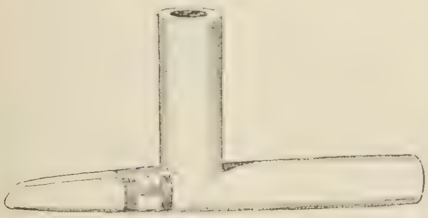

Fig. 175.

CATLINITE PIPE.

Evanston, Illinois.

Cat. No. 175916, U.S.N.M. Collected by William Porter.

[1] Proceedings American Philosophical Society, 1865–1868, X, p. 274.

not in ridicule, of travelers. With scarcely a single exception among the Siouan pipes the bowl and stem are at right angles to each other.

Fig. 175 is a red "pipe stone" 8 inches long and scarcely an inch in width, the bowl being 5 inches high. It was purchased of a dealer at Evanston, Illinois, by Mr. William Porter, and is probably of no considerable age, and not so well polished as the preceding example, as it was finished probably by means of ordinary sandpaper, a material which the modern Sioux had learned the use of. The base of this pipe is flat, the point or prow running out flat top and bottom, while the sides are convex beyond the base of the bowl, stem and bowl being cylindrical. The prolongation of the stem has been fractured and subsequently repaired in a most ingenious manner with sheet lead, to do which required a groove to be cut on each side of the fracture encircling the stem. From these grooves others were cut along the stem on both sides, into all of which lead was run or fitted and subsequently hammered down, after the broken pieces had been joined. Subsequently the lead was smoothed off level with the surface of the pipe, and the splice was complete. This repaired stem demonstrates that the modern Indian is not devoid of resources of a mechanical nature. A similar piece of work is illustrated by Mr. I. A. Lapham, from Wisconsin, of a fine-grained sandstone calumet on which plates of lead had been employed in repairing a fracture.[1]

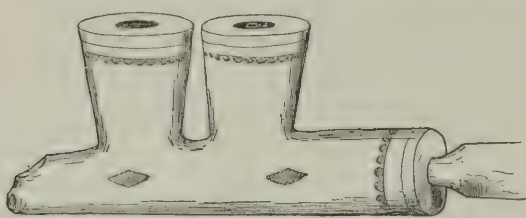

Fig. 176.

DOUBLE-BOWLED CATLINITE PIPE.

After Catlin. Smithsonian Report, 1885, Pt. 2, plate 114.

This pipe (fig. 176) is drawn after an illustration of Catlin, and shows how varied were these Siouan forms, while invariably remaining true to type, notwithstanding its double bowl rising from a single stem.[2] A similar specimen is in the Douglass collection, which was obtained in 1820 by Maj. D. B. Douglass, father of the present owner, in Minnesota, while accompanying Gen. Lewis Cass as astronomer of the expedition sent to make treaties with the Indians, the double bowl possibly being ancient. On the stem of another pipe of catlinite in

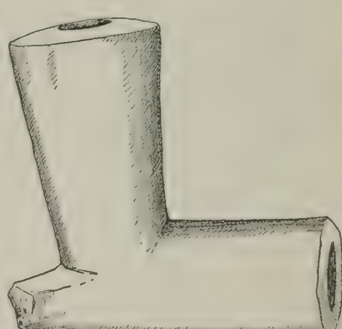

Fig. 177.

SIOUX PIPE.

Fort Buford, North Dakota.

Cat. No. 8496, U.S.N.M. Collected by James P. Kimball.

[1] Antiquities of Wisconsin, p. 83, Smithsonian Contributions to Knowledge, No. 70.

[2] Smithsonian Report, 1885, Pt. 2, plate 114.

the Douglass collection there stands a bear facing the smoker, a peculiarity of which is that the bear's eyes are made of two white beads let into the stone, and evidences apparently the survival on the specimen of a practice noticed among pipes of the mound types.

Fig. 177 is a dull red stone pipe from Fort Buford, North Dakota, collected by Mr. James P. Kimball. It is 3¼ inches long and 3 inches high, stem and bowl openings each being five-eighths of an inch in diameter, the pipe having been cut out by means of a sharp blade, the facets left by the tool remaining distinct. The base is flat, the rest of the stem being cylindrical. The prolongation of the stem is flattened beyond the base of the bowl, its end having been broken off. This pipe is evidently quite modern, as evidenced by the crust of tobacco yet remaining in the bowl, the walls of which are about half an inch thick. The type is distinctly Siouan, though the stem is shorter than are usually those of Sioux pipes. The material is an indurated clay, possibly catlinite, though of a darker color, which may be owing to the stone being saturated with oil or grease.

Fig. 178.
CATLINITE PIPE.
Dakota.
Cat. No. 42669, U.S.N.M. Collected by G. L. Febiger.

A highly polished catlinite pipe (fig. 178) from Dakota, collected by Gen. G. L. Febiger, United States Army, represents a man facing the smoker, the bowl being bored through the head and body. It is about $4\frac{1}{4}$ inches long with a height of $2\frac{1}{2}$ inches. Though the position of the figure is not an easy one it is carved entirely in the round with unusual artistic feeling, the legs being drawn up slightly on the stem with the hands and arms extended along the legs and knees. It is of quite modern form, and there is yet wrapped around the neck a coil of fine brass wire, which in contrast to the cherry red of the stone gives a very pleasing effect. The lobes of the ears are bored evidently for the purpose of decorating them with pendants.

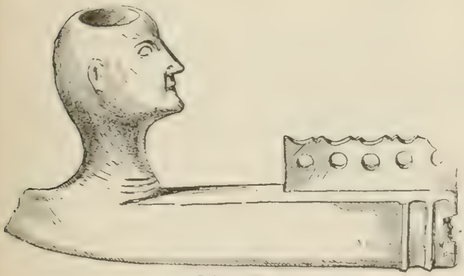

Fig. 179.
SIOUX PIPE.
Upper Missouri River.
Cat. No. 2594, U.S.N.M. Collected by U. S. War Department.

Fig. 179, deposited by the U. S. War Department, is a pipe of black serpentine, captured by the army in conflict with the Indians of the

Upper Missouri drainage, and though differing both in material and certain of the characteristics from the preceding specimen retains much of the Siouan form, though the ridges near the end of the stem are in imitation of metal forms. It is finished with unusual skill. From one end to the other it is $4\frac{3}{4}$ inches long and is about $1\frac{1}{4}$ inches wide. The bowl represents the head of a person, scarcely of Indian type, the sharp chin being markedly noticeable. The ears are bored with perforations an eighth of an inch in diameter, extending into the ear drums. The wing or elevation on the stem is scarcely an eighth of an inch thick and has been perforated by a row of five holes. The opening of the stem is but one-fourth of an inch in diameter, whereas that of the bowl is five-eighths of an inch, which is quite unusual in pipes of the Siouan type. There has been broken from the back of the head a knob intended apparently to represent a knot of hair somewhat on the order of the famous Indian head found by Squire and Davis. It is noticeable how markedly pronounced are the stone pipes having holes laterally bored in their stems, characteristic of those areas where snow lies longest, it being especially a feature of pipes found from the Atlantic to the Pacific north of the Great Lakes.

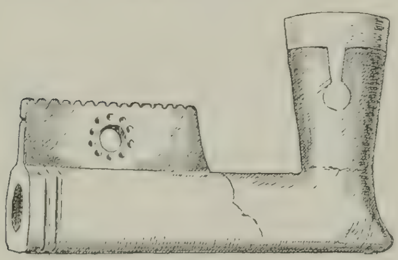

Fig. 180.

LEAD AND STONE SIOUAN PIPE.

Cat. No. 2349, U.S.N.M. Collected by U. S. War Department.

Another of the War Department specimens (fig. 180) captured from the Indians of the drainage of the upper waters of the Missouri retains the type form of the Sioux, the prolongation of the stem being less pronounced than usual. It is made from a black stone of medium hardness, possibly a chlorite, and is about the same dimensions as the last pipe except that the stem opening is much larger in proportion than in the last one, being half an inch, while the bowl is three-fourths of an inch in diameter. An alate, perforated wing extends along the base as in the last specimen; this wing is perforated from side to side for the purpose of attaching a cord; from the perforation along one side of this wing there extends a wavy line incised with such care as to impress the observer that it has some special significance. About one-half inch of the top of the bowl is composed of lead, which is held in position by three plates having discoidal ends which are inlaid on the stone at equal distances around the bowl.

Fig. 181 is a pipe of this type from the Upper Missouri, collected by the U. S. War Department. It is $4\frac{1}{2}$ inches long and made of metal, apparently lead. In order to protect the lead from the heat of the burning tobacco a lining of sheet copper has been inserted in the bowl, and laps over the top, the bowl in its exterior shape being round, whereas the stem is square. Though there are upon this pipe no discernible

mold marks, the lead part has probably been made for the Indian trade by the whites.

Pipes of the Siouan form appear to be distributed over a wider area than almost any other type, owing in a measure to the attractiveness of the usual red color of the catlinite, which must have been used by the natives for pipes from their earliest acquaintance with it, though others of the Siouan stock appear to have also used stones of their country, such as chlorite and green and gray steatites, as well as black chlorite, and later the white traders have introduced pipes of the same character made of metal, which the Indians have eventually used by inlaying in combination with the various pipe minerals.

Fig. 181.

METAL PIPE.

Upper Missouri.

Cat. No. 2340, U.S.N.M. Collected by U.S. War Department.

The wide distribution of the Siouan rectangular pipe is probably owing to Indians using this type having adopted the smoking habit from the Sioux, who have long traded in catlinite.

The long prow of the typical Siouan pipe appears to give way on the northern and western borders of their territory to a rectangular-stemmed pipe, often having a ring around its stem in relief, and a shortened prow, as is observed among the Ojibways, who are of Algonquin stock. This form, however, appears more modern, and suggests ownership by another people. Hind refers to different tribes affecting different pipe shapes.[1]

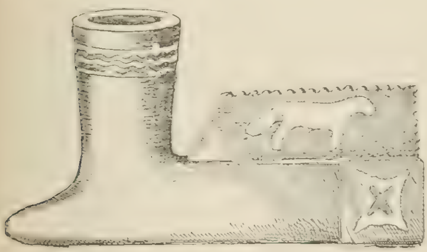

Fig. 182.

INLAID SIOUX PIPE.

Dakota.

Cat. No. 73072, U.S.N.M. Collected by D. B. Wilson.

To the southwest of the Sioux the prow of the pipe is again encountered, though the stem is shorter. With few other pipes is there so strict regard had to characteristics of type and, at the same time, greater latitude allowed for ornamentation of the exterior. In this type the bowl is approximately as deep as the stem is long; the stem or prow may vary in length, and at times an alate projection rises almost like an inverted keel from the top of the stem and extending one-half or two thirds the way from the mouthpiece to the bowl. This wing is usually devoid of ornamentation; at other times, however, its upper edge may be notched, or a greater or less number of holes may be bored

[1] Henry Youle Hind, A Narrative of the Canadian Red River Exploring Expedition of 1857, II, p. 139, London, 1860.

through the keel, or the ornamentation may be of the character of fig. 182, which is a black chlorite, with an inlaying of lead in bands around the upper part of the bowl, made by the Wahpeton Sioux, Dakota, collected by Lieut. D. B. Wilson, United States Army. There is a crude effort at ornamentation by means of a lead plate inlaying of a figure apparently intended to represent a horse. On the stem base there is an inlaid plate of lead of about an inch in diameter let into the stone, into which in turn is inserted a red stone cross, both polished smoothly with the surrounding surface. This pipe was the property of a medicine man of the Wahpeton Sioux, and retains all of the Siouan characteristics, though it is evidently of recent origin.

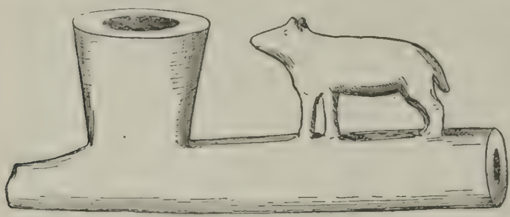

Fig. 183.

SIOUX CATLINITE PIPE.

After George Catlin. Smithsonian Report, 1885, Pt. 2, plate 34.

Fig. 183 is a typical Siouan catlinite pipe drawn after Catlin's illustrations. It is to be doubted, however, whether the animal standing on the stem is intended to represent a pig or a bear. From our acquaintance with totemic customs, however, it may be suspected that the bear was intended. This pipe was the property of a Missouri chief, Haw-che-ke-sug-ga, and, if correctly drawn, is an unusual occurrence, for the animal faces from the smoker, a posture rarely allowed in Sioux pipe figures, and as the animal facing from the smoker is unique, it may be questioned whether Catlin may not have reversed the animal without due consideration.

Fig. 184.

SIOUX PIPE.

Sioux, Dakota.

Cat. No. 43278, U.S.N.M.

Collected by James E. Sebring.

Prof. G. H. Perkins refers to a red pipe-stone specimen presenting some peculiarities from the Champlain Valley, near Burlington, Vermont, which was plowed up on the surface. The bottom is furnished with a regular keel and ornamented with a number of holes made from side to side.[1] The keel-like ornamentation appears to be in some way derived from that so commonly found on the bases of Micmac pipes.

A similar keel has been noted on a metal tomahawk pipe found as far south and east as Chester County, in Pennsylvania, which was made from German silver, evidently copied from Siouan characteristics.

A Catlinite pipe, 6½ inches long, from Sioux, Dakota, collected by

[1] The Calumet in the Champlain Valley, Popular Science Monthly, December, 1893, p. 344, fig. 10.

Mr. James E. Sebring (fig. 184), is, from an artistic point of view, one of the most ornate pipes of Indian origin which the writer has ever seen. The art concept here evidenced is one of the most ancient known, though the shape of this pipe, as the pipe itself, is known to be quite modern. The bowl, in the form of an acorn, is held in the distended jaws of the panther, the eyes, teeth, and ears of which are well carved, the projection extending from the back of the head being intended evidently to afford something to hold the pipe by when smoking it, being akin to the spear on tomahawk pipes, or possibly to projections common to pipes in New Mexico. The opening of the bowl of this pipe is seven-eighths of an inch in diameter, while that of the stem at its end is scarcely one-eighth of an inch. It is singular that a Sioux Indian should have selected so elegant, and at the same time so antique, a style, for in the sculptures of Phœnicia the human head is held in the lion's mouth, the last vestiges of which may yet be encountered in the lion skin over the shoulders of the Greek figures of Hercules; in Babylonia the human face is held in the distorted jaws of a fish, while coming nearer home, to Central and South America, the same principle is embodied in sculptured figures represented as covered with human or beasts' skins or held in their distended jaws, as the panther here holds the acorn. The stem being curved and the Indian finding it impossible to bore a curved hole in stone of uniform hardness has first excavated the bowl, into which he has bored a hole from the base of the stem; from the same hole he has bored in the opposite direction toward the mouthpiece; then from the mouthpiece a hole has been drilled intersecting the latter hole. All that was then necessary to make a continuous tube to the bowl was to plug the hole in the base of the stem, and this was accomplished by neatly inserting a plate over this hole, the lead being rubbed to an even surface with the rest of the stone.

Fig. 185.
STEATITE PIPE.
Mineral County, West Virginia.
Cat. No. 11527, U.S.N.M. Collected by J. A. Davis.

Fig. 185, from West Virginia, collected by Rev. J. A. Davis, represents a much-worn, broken-bowled, small, well-polished, green pipe of the Siouan type, only 2 inches long, with a width scarcely more than half an inch. The wing on the stem would stamp its type, though the locality where found would indicate that it was far from where it was originally made.

Prof. F. W. Putnam, referring to certain burials in cairns in Kansas, considers them more recent than mounds, and instances a number of diminutive catlinite pipes found in these stone piles associated with a glass bead.[1]

From a careful examination of available data the writer can but con-

[1] F. W. Putnam, Report of the Peabody Museum of American Archaeology, II, p. 718.

clude that the typical catlinite pipe was rectangular at the time of the first contact of the French with the Sioux, and that all pipes of this material differing in form are comparatively modern, and, as a matter of course, articles of European manufacture found in burials are of the historic period, as are those catlinites upon which animals are carved.

PIPES OF THE NORTHWEST COAST.

All along the western and northwestern coast of America a most curious style of pipe is found, commonly of very grotesque form and made of a great variety of material, such as wood, stone, antler, and of these materials in combination with metal, bone, and mother-of-pearl. North of California almost all the pipes found not only indicate quite modern origin but, in a measure, are suggestive of being made for sale to the whites, though it can not be questioned that the Haida are remarkable as carvers of great originality and have been known as such from a very early period, their art being of a grotesque originality, rude, it is true, but unique.

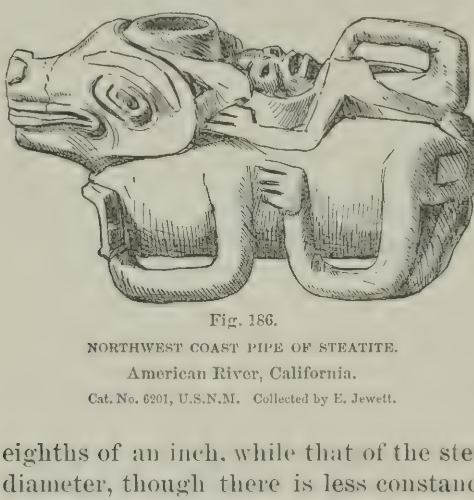

Fig. 186.

NORTHWEST COAST PIPE OF STEATITE.

American River, California.

Cat. No. 6201, U.S.N.M. Collected by E. Jewett.

Fig. 186 is a dark gray pipe of steatite, $4\frac{1}{2}$ inches long, $2\frac{7}{8}$ inches high, and $1\frac{1}{2}$ inches wide, from American River, California, collected by Col. E. Jewett, and does not appear to have been much smoked, for had it been it would have been greased to give it a black color. In this pipe the bowl opening is five-eighths of an inch, while that of the stem is three eighths of an inch in diameter, though there is less constancy in the size of the California pipes than in most others. This specimen is a curious combination of man and beast, quite typical of California Indian art. The main figure is that of some crouching four-footed animal, resembling none with which we are acquainted, though probably readily recognizable by persons familiar with their system of symbolism. Its four feet are curled under the body; a long tail, forming a loop over the back, would suggest that a mountain lion were intended. Carved into the back of this beast, face up, is the diminutive figure of a human being, who lies upon his back. The large eyes and prominent muzzle of the creature represent a grotesque character of work, akin, apparently, to certain rude South American carvings, and in some respects having characteristics encountered at times in ivory carvings from Japan or China, though there is sufficient individuality to entitle it to a place of its own. This pipe is quite massive and has been carved by means of sharp tools of iron, though the work could be done with a sharp-bladed shell or stone.

Fig. 187 from Puget Sound, collected by Lieut. Charles Wilkes, United States Navy, is a combination pipe of wood, bone, and tin, and shows what variety there is at times in modern Indian art. It is a pipe apparently originating on the Pacific coast, intended chiefly to attract travelers. It is 18 inches long and 4 inches high, representing, one might almost say, a farm, houses, and garden. The chimney of the house is composed of a tin cylinder, and at times a brass or copper cartridge is made to answer the same purpose by perforating the side of the shell to allow the smoke to escape into the stem. The sides of the house and part of the balance of the ornamentation consist of bone in thin plates fastened to the wood of which the bulk of this pipe is made. The carving is decidedly characteristic of the locality from which it comes, though the houses, gate, and trees indicate clearly how modern they are. In the prow of a boat-shaped pipe in the U. S. National Museum collection from Puget Sound a disk-like depression has been cut, into which a plate of mica is neatly fitted, and on another a crowing rooster is figured. The inlaying of many of these pipes has been made more

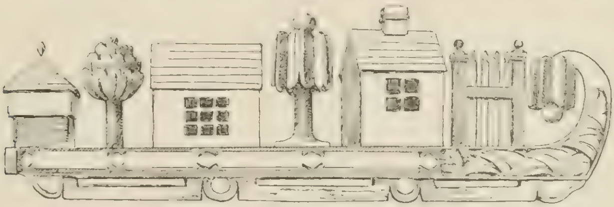

Fig. 187.

PUGET SOUND PIPE.

Puget Sound.

Cat. No. 2604, U.S.N.M. Collected by Charles Wilkes.

effective by using the nacre of the abalone shell, which, with its brilliant green coloring, is most pleasing, especially when used for the eyes of the monsters they adorn. These people carve at times most picturesque and ludicrous figures from deer horns, sawed off at the point where the horn enters the skull, taking every advantage of the shape of the horn to add to the artistic effect of the pipes, and though the totem posts have been so long known, with their quaint, rude figures, one can but wonder to what extent the carving of these people has been influenced by the Japanese, who have long been on the upper coast.

Pipes made by the natives of Queen Charlotte Island and the shores of British Columbia and the Tshimpshian tribes north of Vancouver Island are usually composed of a black slate, representing various animals, man included, and figures in singular postures are most attractive, though modern, and carved with steel tools, with a fidelity sufficiently accurate to enable one to recognize the animals intended, though these pipes of slate appear to represent a manufacture which chiefly aims to attract the tourist and curiosity seeker.

Pipe bowls of the Chinook Indians, according to Bancroft, were made

of wood fitted to elder stems, but the best ones, of stone, elegantly carved, were of Haida manufacture and are obtained from the north.[1]

While there is good reason to doubt if the American Indian on any part of the continent ever knew of the use of the bow or pump drill before the advent of Europeans there is much evidence that throughout the continent fire to light the pipe was made by twirling one stick upon another, and in the Southwest there is evidence that fire was made by plowing or rubbing one stick back and forth in the groove of another.

Hind says of the pipes of the Babeen Indians, "While they exhibit a much higher degree of art than we should expect to find among such a savage race, they are illustrations of their imitative power and ingenious workmanship. The grotesque devices with which their pipes are ornamented can generally be traced to objects which they have seen since they became familiar with the white traders belonging to the Hudson Bay Company on the Northwest Coast."[2]

Gilbert Malcolm Sproat says: "The Aht Indians are fond of tobacco, but they have no medicine pipe, nor do I think they have among them the marked superstitious pipe usuages by which most of the North American Indian tribes are distinguished. They formly had plain cedar pipes (rosh-kuts) devoid of ornament, but there were also to be found in all the tribes the ornamental bluestone (Tshimpean) pipe which had been obtained in traffic with the Northern Indians. The present Aht name for tobacco (Quish-shah) is their word for smoke. Tobacco has been so long known to the natives that they can hardly explain what material they smoked before they had it, but they probably in former times made use solely of the leaves of the small shrub which is to this day mixed with tobacco in their pipes for the purpose of diminishing the intoxicating effect. It is customary after meals to pass the pipe around among the guests."[3]

That smoking tobacco is a modern practice with certain tribes there can be little doubt, and is indicated in the account of Lewis and Clarke, who said of the natives on one part of the Columbia River: "During these preparations he smoked with those about him who would accept tobacco, but very few were desirous of smoking, a custom which is not general among them, and chiefly used as a matter of form in great ceremonies."[4]

These people probably smoked other plants than tobacco, though to what extent it is difficult to say. According to George Gibbs, the Tinneh or Chippewayan Indians of British and Russian America between the Mackenzie and Peel rivers and the Yukon and banks of the Porcupine, about the sixty-eighth degree of latitude, make "no intoxicating drinks whatever, but are passionately fond of tobacco. This taste they of course learned of the whites. Most of the Kutchins

[1] H. H. Bancroft, Native Races of the Pacific States, I, p. 237, San Francisco, 1874.

[2] Henry Youle Hind, A Narrative of the Canadian Red River Exploring Expedition of 1857, II, p. 140, London, 1860.

[3] Scenes and Studies of Savage Life, p. 269, London, 1868.

[4] Lewis and Clarke's Expedition to the Rocky Mountains, II, p. 15, Philadelphia, 1814. See also J. H. McCulloh, Researches, p. 91, Baltimore, 1829.

smoke in the same manner that we do, but some of the tribes use the same pipes as the Eskimo and swallow the smoke. This kind of a pipe has a wooden stem 12 inches long slightly curved upward; the bowl is well represented by half of a reel for winding sewing cotton upon, and the hole in the pipe is about the same as that in the spool."

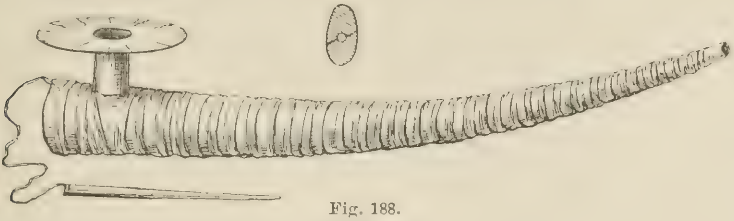

Fig. 188.

ESKIMO PIPE.

After George Gibbs. Smithsonian Report, 1866, p. 324.

The pipe is of the shape shown in fig. 188. "The bowl is made of metal. They do not smoke pure tobacco in it, but mix it with the scrapings of willow."[1]

The curves of pipes of this type vary greatly, depending in a great measure upon the locality where found, the bowls at times being of stone and the sizes of the stems increase as the Siberian coast is approached. Examples in the U. S. National Museum may be seen with less curve than has the one here illustrated, or with even more curve than fig. 189, which is an Eskimo pipe collected at Nome Island, Alaska, by Prof. I. C. Russell. It is of wood, its length being 7½ inches, or sitting up, about 7 inches, and, as with all pipes of extreme Northwestern America, the stems are so constructed as best to allow the owner to collect the nicotine or juices of the plant smoked. This pipe, while not so heavy and thick in the stem as many from the Russian possessions, resembles the latter greatly and is presumably copied from the Russian type.

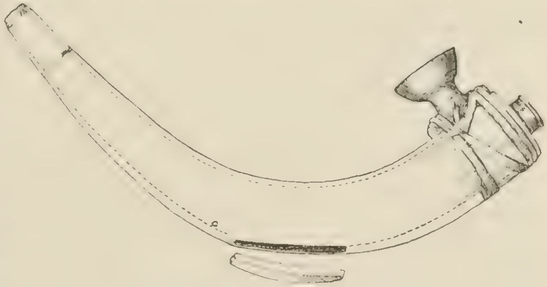

Fig. 189.

RUSSIAN TYPE OF ESKIMO PIPE.

Nome Island, Alaska.

Cat. No. 153437, U.S.N.M. Collected by I. C. Russell.

The bottom of the stem has a small opening like a trapdoor, which can be closed at pleasure while in general use. The stem is loosely packed with some absorbent. This in turn is taken out by opening the plate or trapdoor and either smoked or eaten, a practice customary with the Eskimo. These stems are made of wood scraped to a thickness of from

[1] Smithsonian Report, 1866, p. 324.

one-sixteenth to one eighth of an inch, the mouthpiece usually consisting of a hollow bone plug, the opposite end being often stopped with a copper pistol cartridge. The bowl consists of a compact green serpentine, its opening being scarcely more than one-fourth of an inch in diameter, its base being so shaped as to fit the stem closely and is held in position by a strap of sealskin; at other times they are fitted into shoulders. This arrangement enables the smoker to take his pipe apart and lose none of the contents of bowl or stem, which is considered of great value.

This type of pipe appears closely allied to the Japanese pipes, the most ancient of which, according to the Marquis of Nadaillac, date of the seventeenth century.[1] They appear to have been introduced either by way of Siberia or the Kurile and Aleutian islands, which would indicate that the use of tobacco had practically circumnavigated a large part of the globe, and been returned to America from Asia. Whether the first knowledge of tobacco which the Europeans had came from Spanish, French, or English sources, there is no doubt that its use quickly spread from the eastern side of the American continent, and the plant was thence distributed as a plant possessing valuable medicinal properties to the most distant parts of Europe, then to Asia, and thus again to the American continent, entering by the west. The shapes of pipes would be governed, presumably, largely by local surroundings and supply, and also to some extent by individual taste. Tobacco after its introduction into Europe rapidly came into general use. In 1774 P. Le Roy describes the experiences of four Russian sailors who were left on shore on the island of East Spitzbergen, who "carried a tinder box and tinder, a bladder filled with tobacco, and every man his wooden pipe."[2] All Russian sailors at this time were said to be expert carpenters.

Captains Cook, Clerke, and Gore, in their expedition to the Pacific in 1776 to 1780 on the North American Coast, refer to the natives being in possession of iron between latitude 61° 30″ north and 53° 35″ north. At Unalaska, in 53° 35″ north, on the Alaskan peninsula, Cook refers to the natives trading some fishing implements for tobacco,[3] and says there are few that do not both smoke and chew tobacco and take snuff.[4]

The natives about latitude 59° 37′ 30″ and longitude 197° 45′ 48″, Cook says, "seemed perfectly unacquainted with any civilized nation; they were ignorant of the use of tobacco; nor did we observe in their possession any foreign articles, unless a knife may be considered as such."[5]

[1] Les Pipes et le Tabac; Matériaux pour l'Histoire Primitive et Naturelle de l'Homme, November, 1882, p. 499, note.

[2] P. Le Roy, A Narrative of the singular Adventures of four Russian Sailors, from the German, p. 52, London, 1774.

[3] Voyage to the Pacific Ocean, p. 357, note 2, London, 1784.

[4] Idem, p. 109.

[5] Idem, III, p. 16.

Cook speaks of the natives of the Alaskan Coast being acute traders, even requiring pay for grass and endeavoring to get pay for water. He speaks also of the carvings of their canoes.

G. H. Von Lingsdorf refers to the Aleutian Islanders in the first decade of this century as not being "addicted to smoking, but are passionately fond of snuff. They will work a whole day at the hardest labor to get a single leaf of tobacco as their wages, and when obtained they prepare it for use by grinding it to powder in a mortar made of the bones of whales, mixing it with ashes and water."[1]

The Kutchin and eastern Tinneh, we are informed by Mr. W. H. Dall, use a pipe modeled after the clay pipes of the Hudson Bay Company, but he says "they also carve very pretty ones out of birch knots and the roots of the wild rosebush."[2]

The writer is informed by Capt. E. P. Herendeen, who has spent many years in northern Alaska, that the natives use willow twigs, which have been cut crosswise, for smoking purposes. The Siberian natives use the willow root for dyeing, but the remainder of the root is used for smoking.

At Point Barrow, in 1837, we are told "the grand article in demand here was tobacco, which, as in Dease Inlet, they call tawac or tawacah, a name acquired, of course, from the Russian traders. Not content with chewing and smoking it, they swallowed the smoke until they became sick, and seemed to revel in a momentary intoxication. Beads, rings, buttons, fire steels, everything we had, were regarded as inferior to tobacco, a single inch of which was an acceptable equivalent for the most valuable article they possessed."[3]

Sir Edward Belcher says of the Point Barrow Eskimo in 1825–1829: "They had long had the habit of smoking, but used the stem and down of a peculiar grass steeped in some aromatic gum, probably derived from a fir. They did not use tobacco until we introduced it."[4]

John Murdoch, who was a member of the International Polar Expedition to Point Barrow, Alaska, 1881–1883, has very fully discussed the smoking habit of these natives. Among other things relating thereto, he says: "The only narcotic in use among these people is tobacco, which they obtain directly or indirectly from the whites, and which has been in use among them from the earliest time when we have any knowledge of them. When Mr. Elson, in the *Blossom's* barge, visited Point Barrow in 1826, he found tobacco in general use and the most marketable article. This undoubtedly came from the Russians by way of Siberia and Bering Strait, as Kotzebue found the natives of

[1] Voyages and Travels, Pt. 2, p. 48, London, 1813.

[2] Alaska and its Resources, p. 81, Boston, 1870.

[3] Thomas Simpson, Narrative of the Discoveries on the North Coast of America, effected by the officers of the Hudson Bay during the years 1836–1839, p. 156. London, 1843.

[4] Works of Art by the Esquimaux, p. 133, Icy Cape and to the North, 1825–1829, Transactions Ethnological Society, London.

the sound which bears his name, who were in communication with the Asiatic coast by way of the Diomedes, already addicted to the use of tobacco in 1816. It is not probable that tobacco was introduced on the Arctic coast by way of the Russian settlements in Alaska. There were no Russian posts north of Bristol Bay until 1833, when St. Michael's redoubt was built. When Captain Cook visited Bristol Bay, in 1778, he found that tobacco was not used there, while in Norton Sound the same year 'the natives had no dislike to tobacco.'"

Neither was it introduced from the English posts in the east, as Franklin found the Kûñmûdlĭñ not in the habit of using it. "The western Esquimaux use tobacco, and some of our visitors had smoked it, but thought the flavor very disagreeable." Nor had they adopted the habit in 1837. When the *Plover* wintered at Point Barrow, according to Dr. Simpson's account, all the tobacco, except a little obtained from the English discovery ships, came from Asia, and was brought by the Nunatañmiun. At present the latter bring very little, if any, tobacco, and the supply is obtained directly from the ships, though a little occasionally finds its way up the coast from the southwest. They use all kinds of tobacco, but readily distinguish and desire

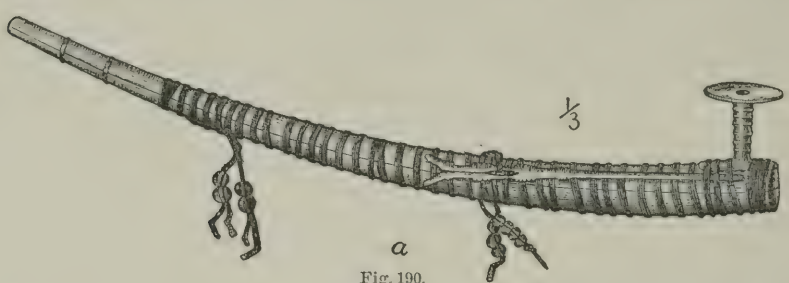

Fig. 190.

ESKIMO PIPE

After John Murdoch. Ninth Annual Report of the Bureau of Ethnology, p. 67.

the sorts considered best by the whites. For instance, they were eager to get the excellent quality of "navy" tobacco furnished by the commissary department, while one of our party who had a large quantity of exceedingly bad fine-cut tobacco could hardly give it away. * * * The habit of chewing tobacco is almost universal. Men, women, and even children, though the latter be but 2 or 3 years old and unweaned, when tobacco is to be obtained, keep a "chew," often of enormous size, constantly in the mouth. The juice is not spit out, but swallowed with the saliva, without producing any signs of nausea. The tobacco is chewed by itself and not sweetened with sugar, as was observed by Hooper and Nordenskiold among the Chuckches.[1]

Fig. 190, from Utkiawĭn, Alaska, collected by Mr. John Murdoch, has an iron bowl, noticeable for the ornamentation of the shank. This has evidently been heated and shrunk on. The wooden stems of these pipes appear to be willow or birch and are in two longitudinal sections, held

[1] The Point Barrow Expedition, Ninth Annual Rept. Bureau of Ethnology, p. 65.

together by the lashing of seal-skin thong which serves to attach the bowl to the stem. This lashing was evidently put on wet and allowed to shrink, and the ends are secured by tucking under the turns. The whipping at the mouthpiece is of fine sinew thread. A picker of steel for cleaning out the bowl is attached to the stem by a piece of seal thong, the end of which is turned under the lashing.

Fig. 191, from Utkiawin, Alaska, also collected by Mr. John Murdoch, has a bowl of rather soft greenish-gray slate. The stones are always of the same material and put together in the same way, but are some-

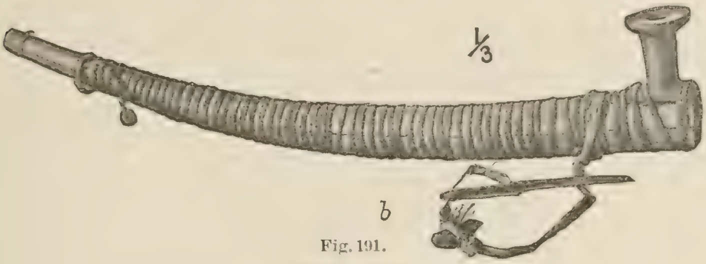

Fig. 191.

ESKIMO PIPE.

After John Murdoch. Ninth Annual Report of the Bureau of Ethnology, p. 67.

times lozenge shaped instead of elliptical in section. The lashing is sometimes of three-ply sinew braid. The bowl shows the greatest variation both in form and material.

Fig. 192 is a bowl of walrus ivory lined with copper from Utkiawin, Alaska, collected by Mr. John Murdoch. "Antler and stone pipes of this pattern and rather small are usually carried by the men out of doors, while the more elaborate metal pipes, which are often very large and handsome (I have seen some with a saucer 3 inches in diameter) are

Fig. 192.

ALASKAN PIPE.

Utklawin, Alaska.

Cat. No. 89285, U.S.N.M. Collected by John Murdoch.

more frequently used in the house and by the women. The stem is usually a foot to 13 inches long, though pipes at least 18 inches long were seen. To most pipes are attached pickers, as in the type specimen. The picker is in all cases of metal, usually iron or steel, but sometimes of copper. When not in use the point is tucked under the lashing under the stem. The pipes are readily taken apart for cleaning."

Fig. 193, collected by Mr. John Murdoch, at Utkiawin, Alaska, is a unique specimen and of the most primitive character.

It is simply a rough willow stick, slightly whittled into shape, split and hollowed out like a pipe stem. It is held together by a whipping of sinew thread, and a lashing of deerskin fastened by a slipknot at one end, the other being tucked in, as usual. A small funnel-shaped hole at one end serves for a bowl, and shows by its charred surface that it has actually been used. This pipe was bought from one of the Nunatañmiun, who were in camp at Pernyú in 1883, and shows its inland origin in the use of the deerskin thong. A coast native would have used seal thong. The pipe is carried at the girdle either with the stem thrust inside the breeches or in a bag attached to the belt. It is a long, narrow cylindric bag, made of four white ermine skins, with two hind legs and two tails forming a fringe round the bottom which is of dressed deerskin, in one piece, flesh side out. Tobacco is carried in a small pouch attached to the girdle, and tucked inside the breeches, or sometimes worn under the jacket, slung round the neck by a string or the necklace. * * * Tobacco as prepared for smoking by the Eskimo consists of common black cavendish or "Navy" tobacco, cut up very fine and mixed with finely chopped wood in the proportion of about two parts of tobacco to one of wood. We were informed that willow twigs were used for this purpose. The method of smoking is as follows: After cleaning out the bowl with the picker a little wad of deer hair, plucked from the clothes in some inconspicuous place, generally the front skirt of the inner jacket is rammed down to the bottom of the bowl. This is to prevent the fine tobacco

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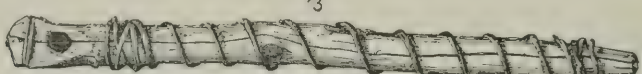


Fig. 193.

ESKIMO PIPE OF WILLOW.

After John Murdoch. Ninth Annual Report of the Bureau of Ethnology, p. 68, fig. 7.

getting into the stem and clogging it. The bowl is then filled with tobacco, of which it holds only a small quantity. The mouthpiece is placed between the lips, the tobacco ignited and all smoked out in two or three long inhalations. The smoke is very deeply inhaled and allowed to pass out slowly from the mouth and nostrils, bringing tears to the eyes, often producing giddiness, and almost always a violent fit of coughing. I have seen a man almost prostrated from a single pipe full. This method of smoking has been in vogue from the time of our first acquaintance with these people. Though they smoke little at a time they smoke frequently when tobacco is plentiful. The use of the Kui'nyu, which name appears to be applied to the native pipes, seems to be confined to the adults. We knew of no children owning them, though their parents made no objection to their chewing tobacco or owning or using clay or wooden pipes, which they obtained from us. They carry their fondness for tobacco so far that they will even eat the oily refuse from the bottom of the bowl, the smallest portion of which would produce nausea in a white man. This habit has been observed at Plover Bay, Siberia. Tobacco ashes are also eaten, probably for the sake of the potash they contain, as one of the men at Utkiawin was fond of carbonate of soda, which he told the doctor was just like what he got from his pipe. Pipes of this type differing in details, but all agree in having very small bowls, frequently of metal, and some contrivance for opening the stem, are used by the Eskimos from at least as far south as the Yukon Delta (as shown by the collections in the National Museum) to the Anderson River and Cape Bathurst, and have even been adopted by the Indians of the Yukon, who learned the use of tobacco from the Eskimos. They are undoubtedly of Siberian origin, as will be seen by comparing the figure of a Chukch pipe in Nordenskiölds Vega, and the figure of

a Tunguse pipe in Seebohm's Siberia in Asia, with the pipes figured from our collection. Moreover, the method of smoking is precisely that practiced in Siberia, even to the proportion of wood mixed with tobacco. The consideration of the question whence the Siberians acquired this peculiar method of smoking would lead me beyond the bounds of the present work, but I can not leave the subject of pipes without calling attention to the fact that Nordenskiöld has alluded to the resemblance of these to the Japanese pipes. A gentleman who has spent many years in China also informs me that the Chinese pipes are of a very similar type and smoked in much the same way.

At Kolymsk in 1820, according to Ferdinand Wrangell, the tobacco was mixed by the Russians with finely powdered larch wood to make it go farther.[1]

Sir William Edward Parry, while in the *Fury* and *Hecla*, 1821–1823, collected upward of five hundred words, but the list contains no word either for pipe or tobacco.[2]

This would indicate beyond doubt that the language contained none such and that the smoking habit was comparatively new to them, which certainly appears the accepted belief.

Murdoch says: "We have indeed positive proof that the people of the Mackenzie region acquired the habit of smoking from their western neighbors."[3]

Of their present habit, however, he says: "All the Eskimo, with the exception of the so-called Arctic Highlanders, of Smith Sound, and perhaps some of the more remote tribes of the central region, are passionately addicted to the use of tobacco. East of Cape Bathurst it is perfectly well known that the taste was acquired directly from the Europeans, Danes and English, who have made more or less permanent settlement in these regions. On the other hand, the first explorers who visited the Eskimo on the northwest coast of America found tobacco already in use among them."[4]

Capt. F. W. Beechy says of the natives of Kotzebue Sound in 1825–1828: "We were joined by three Caiacs from some tents near us and four from the river who were very troublesome, pestering us for tawack, and receiving the little we had to give in the most ungracious manner without offering any return."[5]

Mr. James G. Swan says of the natives of Cape Flattery: "After eating they sometimes, but not always, indulge in a whiff of tobacco, but smoking is not a universal practice among them. * * * Smoking is practiced even less than among some of the tribes east of the Rocky Mountains, and there are no ceremonials connected with its use. Occasionally an Indian will swallow a quantity of smoke, which, being

[1] Narrative of an Expedition to the Polar Sea, 1820–1823, London, 1840.

[2] Journal of a Second Voyage for the Discovery of a Northwest Passage, 1821–1823, London, 1824.

[3] John Murdoch, On the Siberian Origin of Some Customs of the Western Eskimo, American Anthropologist, I, p. 330.

[4] Idem, p. 330.

[5] Narrative of a Voyage to Pacific and Bering Strait, p. 322, London, 1831.

retained a few seconds in the lungs or stomach, produces a species of stupefaction lasting from five to ten minutes and then passing off. The calumet or pipe of peace is qui e unknown among these Indians."[1]

Mr. W. H. Dall refers to the Kutchin Indians of Alaska, who "make pretty pipe stems out of goose quills, wound about with colored porcupine quills."[2]

In the territory contiguous to the Yukon, Dall says "we would stop every few minutes to let the Indians smoke. The operation takes less than a minute. Their pipes are so constructed as to hold but a very small pinch of tobacco. A pinch of tobacco cut as fine as snuff is inserted and two or three whiffs are afforded by it. The smoke is inhaled into the lungs, producing a momentary stupefaction, and the operation is over."[3] The bowls of the Yukon pipes are generally cast from lead. Sometimes they are made of soft bone or even hard wood. In smoking a few reindeer hairs pulled from his parka are rolled into a little ball and placed in the bottom of the bowl to prevent the contents being drawn into the stem.

The Indian pipe Dall considers a copy of the Eskimo pipe, as the latter were the first to obtain and use tobacco. Many of the tribes call it by the Eskimo name. A fungus which grows on decayed birch trees, or tinder manufactured from the down of the poplar rubbed up with charcoal, is used with flint and steel for obtaining a light. The Chuckchees, Mr. Dall says, "use a pipe similar to those of the Eskimo, but with a much larger and shorter stem. This stem is hollow and filled with fine birch shavings. After smoking for some months these shavings, impregnated with the oil of tobacco, are taken out through an opening in the lower part of the stem and smoked over." Mr. Dall also informs the writer that this large pipe with the movable plate in the stem is native to the Asiatic side of Bering Strait. In this stem they also use willow and alder, which, when sufficiently saturated, are smoked. Both willow and sumac are mixed with the tobacco to make it go farther.

Nordenskjöld refers to the Chuckchee pipe, which is similar to that from Point Barrow, which resemble those of the Tunguse. The tobacco, he says, is often first chewed, then dried behind the ear, and kept in a separate pouch suspended from the neck, to be afterwards smoked. The pipes are so small, he remarks, like those of the Japanese, that they may be smoked out with a few strong whiffs. The smoke is swallowed. Even the women and children smoke and chew, and they begin to do so at so tender an age that we have seen a child that could indeed walk, but still sucked his mother, both chew tobacco and smoke.[4]

Mr. W. H. Hooper refers to the Tuski "pipes of wood and ivory, either divided along the middle into two parts for convenience of cleaning, or

[1] The Indians of Cape Flattery, p. 27, Washington, 1870.

[2] Alaska and its Resources, p. 82, Boston, 1890.

[3] Idem, p. 81.

[4] The Voyage of the Vega, p. 116, London, 1881.

with a large trapdoor in the under part which allows a few pieces of dry grass to be laid inside to absorb the moisture, which when closed is covered with a strip of leather which effectually keeps it air-tight. When about to smoke, a pinch of hair plucked from the deerskin frock is pushed with the pricker down the very small hole in the bowl of the pipe. This is to prevent the tobacco from drawing through."[1]

Mr. Henry Seebohm illustrates a pipe of the Tungoosk, which so closely resembles certain of the pipes of the Alaskans, both in bowl and manner of lashing the same to the stem, as well as the shape and lashing of the stem itself, as to leave little doubt of their common origin.[2]

The same author illustrates a pipe of the Samoyede which should be classed as of the same type as those pipes here described, yet presenting other characteristics than such as are embodied in the Alaskan specimens.

Arising probably from similar conditions is an Afridi pipe from the Khyber Pass, in India, illustrated by Pritchett, which has a small brass bowl and a stem composed of two pieces of wood which have first been scooped out and subsequently lashed together with thongs, and so closely resembles the Alaskan type that one would be perfectly excusable in mistaking it for the latter.[3] It appears difficult to determine the period when the pipe appeared first on the extreme northwestern coast of America, and equally so to determine whence it came, its form in many respects resembling more nearly the Chinese than the Japanese type, though there are accounts of the Russians having in the last century attacked Japanese islands and brought away prisoners to Kamtschatka, pipes being referred to among articles enumerated as taken at the same time. The extent of communication between Kamtschatka and the Japanese is little known, though Japanese was taught at Irkutsk about 1807, according to G. R. Von Lingsdorf, who says: "It is worthy of remark that by command of Her Imperial Majesty, the late Empress Catherine, the Japanese language was taught, and the teacher of it was a native of Japan."[4]

Cook informs us that, in 1778, of the islanders near Kamtschatka, there were few who did not both chew, smoke, and take snuff, a luxury which he truthfully says bids fair to always keep them poor.[5]

It is known that about 1764 the Kamtschatdales "sometimes smoked tobacco" which they received from Europe.[6]

"It is said that the Kamtschatdales knew the use of iron even before

[1] Tents of the Tuski, p. 176, London, 1853.

[2] Siberia in Asia, p. 149, London, 1882.

[3] R. T. Pritchett, Ye Smokiana, p. 66.

[4] Voyages and Travels, 1803–1807, Pt. 2, pp. 297, 381, London, 1813.

[5] Voyages to the Pacific Ocean, p. 513, London, 1784.

[6] The History of Kamtschatka and the Kurilski Islands, p. 276, translated by James Grieve, M. D., Gloucester, 1764.

the arrival of the Russians: that they received it from the Japanese who came from the Kurilski Islands, and once to the mouth of the river Kamtschatka, and that the name which the Kamtschadales give the Japanese of Shisman comes from 'shish,' a needle. The Japanese certainly used to come and trade to the Kurilski Islands, for I found there a Japanese saber, a Japanese waiter, and silver earrings, which could be brought from no other place."[1]

The Tchuckchi pipe has apparently traveled across Bering Strait quite recently, judging from the similarity in the pipes on the Asiatic and American sides. The most natural supposition appears to the writer to be that the Tchuckchi in their turn received the pipe from the Japanese by way of the Kurile Islands, they possibly in turn receiving it from the Chinese.

MISCELLANEOUS PUEBLO PIPES.

In the southwestern part of the United States are found a class of pipes usually made of pottery, certain of which resemble the Siouan pipe in a measure, though there is a distinctiveness about them entitling them to be classed by themselves. Those in the collection of the U. S. National Museum are all made from a rude, hard burned, and unglazed black pottery. Some have projections similar to the Sioux pipe, the prow being approximately the same size as the stem, as seen in fig. 194. This specimen, except that it is made of this hard pottery, is not very unlike in outline from the Siouan pipes of the Upper Missouri River drainage. The stem, however, of these southwestern pipes is heavy and thick, as are the walls of the bowls, the stem opening being formed by inserting a stem of grass through the plastic clay and burning it out in firing the pipe.

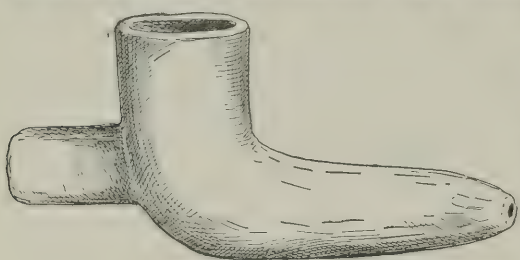


Fig. 194.

MODERN PUEBLO PIPE.

Cat. No. 22968, U.S.N.M. Collected by J. W. Powell.

Fig. 195, from the Wolpi pueblo in Arizona, collected by Col. James Stevenson, is made of this typical hard unglazed pottery, similar to specimens found at times among the Iroquois graves of Canada or the United States, near Lakes Erie, Ontario, and the St. Lawrence River, which have similar stem openings. The inverted terrace-like projection below the bowl indicates how varied it was, and that it was probably intended to hold the pipe by when it was smoked. The outline of the exterior of bowl and stem of this pipe may be duplicated in soapstone in the Carolinas. The pottery from which these pipes are made, though of recent manufacture, does not compare with that of the ancient

[1] The History of Kamtschatka and the Kurilski Islands, p. 186.

pueblo tubular pipes, which in its turn is less firm in texture than the rectangular Mexican pipe with glazed surface, which the writer attributes to Spanish origin.

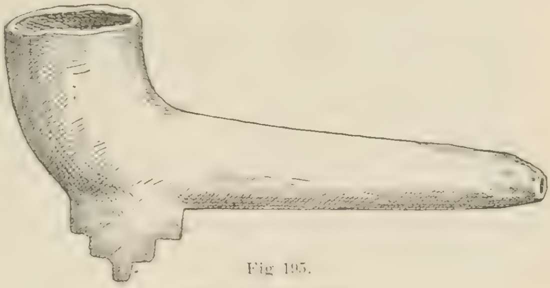


Fig. 195.

WOLPI PUEBLO PIPE.

Wolpi Pueblo, Arizona.

Cat. No. 128460, U.S.N.M. Collected by James Stevenson.

Fig. 196 is a hard-burned and unglazed thick bowl and thick-stemmed pottery specimen of dark brown color from New Mexico, collected by Maj. J. W. Powell. It is 2 inches long and 1½ inches wide. The projection is square, and the stem hole is evidently intended for a separate stem. The difference in position of these projections, without other evidence, would be almost convincing that the form of this pipe was in a transition stage.

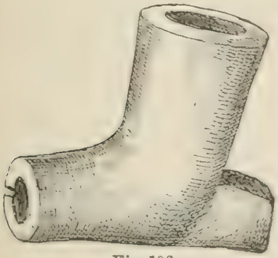


Fig. 196.

MOKI PUEBLO PIPE.

Moki Pueblo, New Mexico.

Cat. No. 22969, U.S.N.M.

Collected by J. W. Powell.

Fig. 197 represents a cast of a greenstone pipe found near Santa Fe, New Mexico, collected by Maj. W. S. Beebe. It is of unusual size, being 12 inches long and 7½ inches high, having a bowl the greatest exterior diameter of which is 2½ inches. This pipe is of typical Mexican shape, and is finished with such artistic skill as to leave little doubt of its being of ceremonial importance to the tribe possessing it. The stem curves gracefully into the bowl, the top of which is carved in the form of an eagle or hawk facing the smoker. Crawling along the sides of the stem and its base, reaching two-thirds of the way up the bowl, are three rattlesnakes; the fourth snake reaches along the upper part of the stem nearly to the end, its tail being on the bowl. The rattles of the snakes are well defined. Above each of the snakes, crawling up the bowl, are the figures of three separate human beings, as though each snake were crawling toward a separate person. The original of this pipe, which appears to be highly polished, in the writer's opinion is one of those presented to

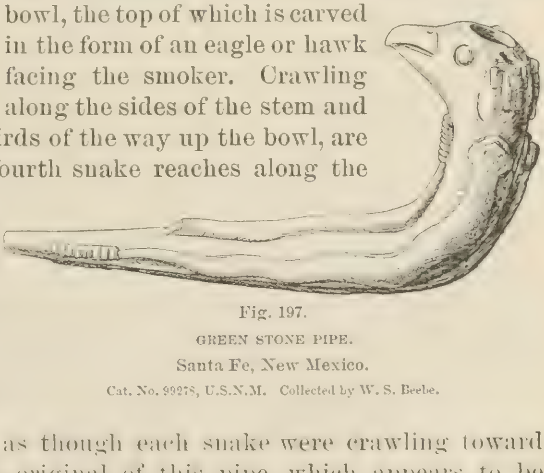


Fig. 197.

GREEN STONE PIPE.

Santa Fe, New Mexico.

Cat. No. 99278, U.S.N.M. Collected by W. S. Beebe.

the Indians upon certain solemn occasions in commemoration of some treaty, and which were intended as reminders of some notable event or agreement undertaken. To one such in New York a reference has been preserved.

Dr. J. Walter Fewkes found the natives of Tusayan, New Mexico, smoking upon all ceremonial occasions the *Nicotiana attenuata* (Piba; from napi, leaf; paku moisture), which forms also part of nearly all prayer offerings.[1]

Fœniculum officinale (kwanwa-piba; from kwanwa, sweet; piba, tobacco)[2] is used as a substitute for piba, but is never smoked ceremonially. The same term applies to tobacco obtained from the whites, which is not used ceremonially.

DELAWARE TYPES.

Holm, as quoted by Dr. C. C. Abbott, says of the Delaware Indians: "They make tobacco pipes out of reeds about a man's length. The bowl is made of horn, and to contain a great quantity of tobacco. They generally present these pipes to their friends. They made them otherwise of red, yellow, and blue clay, of which there is a great quantity in the country, also of white, gray, green, brown, black, and blue stones, which are so soft that they can be cut with a knife. Of these they make their pipes a yard and a half long."[3]

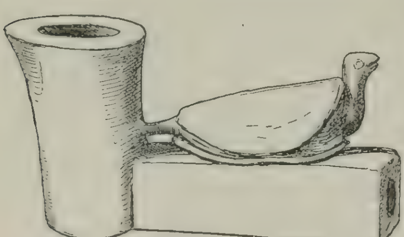


Fig. 198.
DELAWARE PIPE.
Delaware.
Cat. No. 31897, U.S.N.M. Collected by S. S. Haldeman.

Fig. 198, collected by Prof. S. S. Haldeman, of Delaware, differs in certain respects from pipes found elsewhere and points to a type distinct from any yet described. This pipe is about 3 inches long and is made from a compact black stone, probably a slate. The round bowl of this type often has a slight lip in front, and the stem is usually externally square, with some animal carved upon it facing the smoker. The diameter of the bowl opening is five-eighths of an inch, while that of the stem is but one-fourth of an inch; this proportion usually being constant in all typical specimens. The turtle crawls toward the smoker, its head, neck, eyes, and both shells being distinguishable, though the feet and legs are not. The work on this pipe appears to be done by means of steel tools, file marks being distinct. Dr. Abbott refers to pipes of this type—one from Delaware, the other from Pennsylvania, made of a greenish compact serpentine.[4]

Another specimen of the Cherokee pipe (fig. 199) found in Cherokee

[1] American Anthropologist, January, 1896, p. 19.
[2] Idem, p. 20.
[3] Primitive Industry, p. 316, Salem, 1881.
[4] Idem, pp. 321, 322.

County, North Carolina, and collected by Gen. J. T. Wilder, is $3\frac{1}{2}$ inches long and made from a dark-green chlorite. The characteristic lip of the bowl is pronounced, the bear facing the smoker supplants the turtle of the preceding specimen. The bear stands on all four feet, and is carved in the round, his front and hind claws being represented, though the mouth and eyes are not. Pipes of this type are usually ground to quite a smooth surface, and are decidedly symmetrical, being among the most modern of distinctively American Indian pipes.

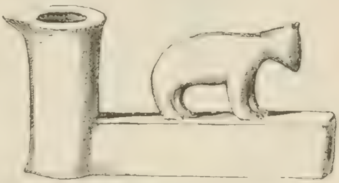


Fig. 199.

CHEROKEE PIPE.

Cherokee County, North Carolina.

Cat. No. 31385, U.S.N.M.

Collected by J. T. Wilder.

Another pipe of this type (fig. 200) from North Carolina and collected by Mr. James Mooney, differs from the preceding figures only in the character of the stem, which is round. The animal figured is probably a gray squirrel, with its bushy tail, in the act of eating, or rubbing its face. The specimens of these pipes will in all probability, when hereafter found, demonstrate that while bowl and stem cavities remained constant the animals upon their stems will differ because of their having a totemic significance, as appears highly probable of animal figures wherever found, especially as those which are recognizable are known totems of American tribes.

Mr. D. B. Brunner figures a pipe of this type from the collection of Gen. George M. Keim, of Berks County, Pennsylvania, which has a square stem and is without ornamentation and made of a dark serpentine, the pipe being finely polished.[1]

In the museum of the University of Pennsylvania are two pipes of this type from North Carolina, one plain, the other having a bear on the stem.

Fig. 200.

CHEROKEE STONE PIPE.

Cherokee County, North Carolina.

Cat. No. 13447, U.S.N.M. Collected by James Mooney.

INDETERMINATE TYPES.

Fig. 201, from Hanover, Jefferson County, Indiana, collected by Mr. George Spangler, is a type specimen of a distinct class of pipes of rectangular shape, which are found in several States and are usually finished with some skill. The one here figured is 3 inches long, $1\frac{1}{2}$ inches high, and is $1\frac{1}{4}$ inches wide, with a bowl opening three-fourths of an inch in diameter, while that of the stem is only three-sixteenths of an inch. They are apparently intended for smoking without a separate stem, and in dimensions of bowl and stem cavities approached those of the curved-base mound pipes. This one is made of a light gray ophiolite and is finished with unusual skill, the surface having a glass-like

[1] The Indians of Berks County, Pennsylvania, p. 96, fig. 97, Reading, 1881.

polish. Every exterior tool mark is obliterated. The bowl has what appears to be quite an unnecessary thickness on the side from the smoker, though it is evidently not the result of accident.

Fig. 202, from Pike County, Missouri, collected by Mr. J. C. Watkins, is made of a light-gray indurated clay, and is about the same size as the preceding specimen. Facing from the smoker there is carved the head of a bird or beast, it is impossible to say which; the surface, however, is merely smoothed, without effort at polishing, the creature's eyes are cut in intaglio, the mouth being indicated by a straight line cut into the stone. The head is slightly broader than the bowl, on the upper right-hand rim of which are eight incised lines, whether for ornament or as a record of some event it would be impossible to say. These bowls are evidently bored by means of tubular metal drills, as indicated by the uniform size of their perforations, though there is in the U. S. National Museum collection a specimen made of catlinite which was found in Baraboo, Sauk County, Wisconsin, which has been bored with a solid drill. The surfaces of this latter are merely smoothed, without effort at polish, the specimen having evidently been blocked out by sawing. The pipes of this type in the collection of the U. S. National Museum are almost too few in number for one to draw definite conclusions from, and while so different in exterior from the curved-base mound pipes, there appears a kinship between the two in size of bowl and stem. Another pipe of this character was referred to by Mr. John P. Jones, in a letter to Dr. E. A. Barber, as coming from Keytesville, Missouri.

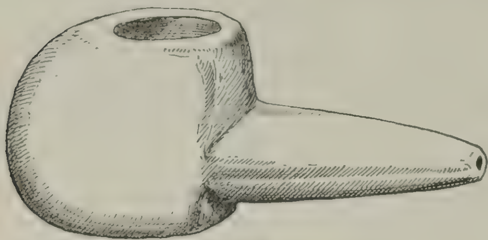


Fig. 201.

RECTANGULAR PIPE.

Jefferson County, Indiana.

Cat. No. 39073, U.S.N.M. Collected by George Spangler.

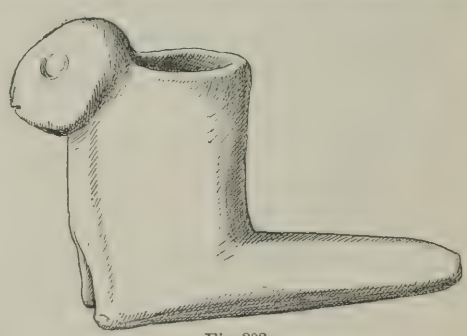


Fig. 202.

RECTANGULAR PIPE.

Pike County, Missouri.

Cat. No. 34383, U.S.N.M. Collected by J. C. Watkins.

Fig. 203, from Arizona, collected by Maj. J. W. Powell, is in form not unlike the familiar Powhatan pipe of commerce. It is made of a fine-grained red stone, ground into shape with great delicacy, the walls of the bowl being scarcely more than one-sixteenth of an inch thick, though

the walls of the stem may be one-eighth of an inch, the dimensions of the pipe being approximately 1 inch in height, length, and breadth. Its characteristics would appear to indicate a recent period, Major Powell having obtained it from natives still using it.

Fig. 204 is of similar type to the preceding figure and is from southern Utah. It was collected by Maj. J. W. Powell. Though larger than the last, being about 3 inches high and made from a translucent green stone, the walls of the bowl are as delicate and as thin as fine china, the pipes being evidently intended to be smoked with wood, reed, or bone stems. Though these pipes are evidently of Indian origin and finished with unusual skill their form appears to the writer to be due to white influences, as the pipes themselves are quite modern, though there has been no effort to polish them.

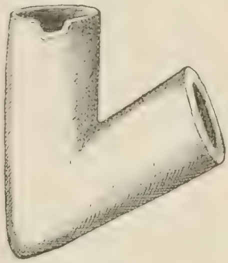


Fig. 203.

ANGULAR PIPE.

Arizona.

Cat. No. 17231, U.S.N.M.
Collected by J. W. Powell.

Among the many pipes of the U. S. National Museum and in other great collections there are occasionally encountered specimens which it is difficult to classify, owing to some peculiarity of material or of treatment, though the occurrence is so rare as to argue in favor of the correctness of the unity of given types, especially when they are found to occur with scarcely an exception in contiguous geographical areas. It may be due in a measure to the fact of other pipes of a distinctive character not having yet been discovered in sufficient quantities to enable the type to be well recognized, or it may well be and probably is to a great extent due to the fancy of their makers desiring to vary a prevailing type, or they were made by white people for sale to the Indians. That pipes of a given area should on occasion be found far from their natural home should not be surprising, when it is considered how great were the distances traveled at times by the Indians on hunting or war parties. Smith, in 1608, found articles of European manufacture in possession of the Susquehannocks, at the head of Chesapeake Bay, which had probably been obtained from the French on the St. Lawrence; and the French, in descending the Mississippi, found the natives in possession of objects which had found their way over the mountains from the English along the seaboard, and heard from the natives also of the Spanish in the Southwest. The resemblance of natural objects of stone or wood to animal forms may possibly account for certain pipes having unusual shapes.

Fig. 204.

ANGULAR PIPE.

Southern Utah.

Cat. No. 14335, U.S.N.M.
Collected by J. W. Powell.

Fig. 205, from Chautauqua County, New York, collected by Mr. O. Edson, is quite a remarkable example of concretion of serpentine some-

what weatherworn, which greatly resembles a bird upon a perch, yet it has on it four shallow depressions made by a solid drill point and along the side of the base a slight groove ground into the stone, slightly smoothed, which constitutes every particle of artificial work on the whole specimen, all of which could not have required one hour's time. The object is 5 inches long and 3½ inches high, with a width of 1¾ inches. The body appears like that of a bird, is well formed, and of so distinct a character as to have suggested to many persons that a parrot was here represented, and the drill marks and grinding tool have been brought into play to heighten the resemblance. The pipes herein referred to as not properly belonging to any type described may upon further investigation be assigned to some one or other of the dozen or more figured, or may be found to belong to types of which there are examples in collections with which the writer is not familiar. They may be very ancient or possibly quite modern. It should be remembered, however, that among the American pipes archæologists as a rule are prone to attach to them too great an antiquity, and consequently few pipes are described as belonging to the historic Indian. Mr. M. C. Read says that "near Willoughby, in Lake County, Ohio, is a site of an Indian village which has furnished a great variety of relics. A very interesting and instructive collection of pipes finished and unfinished was made from this locality and is now in the Metropolitan Museum in Central Park, New York. These show that water-worn pebbles were selected, exhibiting slightly an animal form, which the pipe maker picked into a more perfect animal shape, without much apparent design of imitating any particular species. These were the work of modern Indians and were greatly inferior to the specimens obtained from the mounds."[1]

Fig. 205.

NATURAL FORM.

Chautauqua County, New York.

Cat. No. 22167, U.S.N.M. Collected by O. Edson.

Prof. Daniel Wilson sees matter worthy of note in the supposed correspondence between the ancient Peruvian tobacco mortars and the stone pipe of the mound builders, with their imitations of birds of the southern continent.[2]

Like resemblances may be observed between many objects from the southern and northern continents, though that there was relationship between them, especially in the pipes, will not be conceded at the present day, for there is no single instance in which a southern bird or animal has been recognized upon a mound pipe, nor, so far as the writer

[1] Archæology of Ohio, p. 51, Cleveland.

[2] Prehistoric Man, I, p. 381, London, 1876.

can learn, did the Peruvians or other South Americans ever use the pipe prior to the coming of the Europeans.

Squier and Davis illustrate, however, a pipe apparently of the character of that illustrated by De Bry, which was found in a mound in South Carolina.[1]

A somewhat similar specimen is figured by Thruston as coming from the stone graves of Tennessee.[2]

SOUTHERN TYPES.

These pipes, however, differ greatly from those found by Mr. Clarence B. Moore in his extensive and very careful explorations made in Florida, in its mounds, which were commonly of the type having large bowls and stems, such as have been herein referred to. One of these, found in Grant mound, had a small ornament of sheet copper fastened by an encircling cord beneath the margin of the bowl facing the smoker which crumbled into dust upon exposure to the air,[3] and it is believed that the true Florida pipe will be found to belong to the large bowl and stem type, of which Mr. Moore has found a number, both of stone and of earthenware. In the Steiner collection, in the U. S. National Museum, there is an interesting pipe of stone from the Etowah mound in Bartow County, Georgia, the stem of which is broken off and upon which there is carved a grotesque figure facing the bowl, of which it is difficult to say whether the workman designing it intended it to represent a man or a monkey.

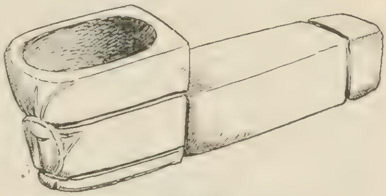


Fig. 206.

CHEROKEE TYPE OF SAWED STONE PIPE.

Howard County, Missouri.

Cat. No. 62030, U.S.N.M. Collected by C. T. Turner.

Prof. Cyrus Thomas illustrates a pipe from Hollywood mound, in Richmond County, Georgia, representing, he claims, the head of an owl, though he found in the same mound, 6 feet below the surface, a fragment of blue porcelain, upon the surface of which there is the well-recognized head of a milch cow.[4]

This pipe, however, has the band upon it so commonly noticed among the pipes of North Carolina and Georgia. One of the most remarkable pipes which has come under the writer's notice is that referred to in a private letter of Col. Bennett H. Young, of Louisville, Kentucky, the stem of which was covered with mica. "Very thin flakes were used in this ancient electroplating and by some kind of glue known to these people, the mica being rolled around the stem of the pipe and put on very artistically and in such manner that the chem-

[1] Ancient Monuments of the Mississippi Valley, p. 195, fig. 80.

[2] Antiquities of Tennessee, p. 180, fig. 78, Cincinnati, 1890.

[3] Certain River Mounds of Duval County, Florida, p. 36, fig. 28.

[4] Twelfth Annual Report of the Bureau of American Ethnology, p. 326, fig. 205.

ical changes in the soil of at least five hundred years had not disturbed it in the least."

Colonel Young thinks that, in Kentucky, pipes of stone antedate and are more numerous than clay pipes, the typical shapes of which are of animals, now and then birds, paroquettes being more numerous than other birds. Among the minerals employed in pipe manufacture he mentions oolitic limestone, gray limestone, bastard granite, slate, and frequently catlinite. Figures, he says, not always, but generally, face the smoker. The stems were of clay and also of reed. One pipe from Richmond, Madison County, Kentucky, was made from coral. In western Kentucky, on the Kentucky and Cumberland rivers, clay was always used, but pottery pipes are rare after passing Barren River, going east. Mr. Gates P. Thruston illustrates a type pipe from the stone graves of Tennessee, which is closely allied to these pipes, the bowls of which are clasped in a person's arms; the peculiarity of one is that the head of the figure is attached to the pipe bowl and in front of it, the arms being represented with the open hands pressing against the breast; the legs are drawn up the bowl, projecting from the back.[1]

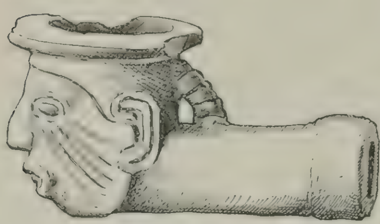


Fig. 207.

CHEROKEE STONE PIPE.

Bradley County, Tennessee.

Cat. No. 131619, U.S.N.M. Collected by J. P. Rogan.

A fine-grained, small, calcareous brownstone pipe from Howard County, Missouri (fig. 206), collected by Mr. C. T. Turner, is only 2 inches long, has a square stem, and is a well-finished little specimen. On the side of the bowl away from the smoker a quaint human face has been cut by incisions to represent face, eyes, and nose, and from the top of the incision forming the face a number of gracefully curved lines arise, as though intended to represent plumes. While the bowl appears unique, its stem would indicate that it belonged to the Cherokee type.

Fig. 208.

CHEROKEE POTTERY PIPE.

After Clarence B. Moore. Certain aboriginal mounds of the Georgia coast.

One of the most artistically symmetrical stone pipes of the U. S. National Museum collection (fig. 207) is from Bradley County, Tennessee, collected by Mr. J. P. Rogan, and is 3 inches long. The man's face is well executed, facing from the smoker, and appears to represent an Indian, upon whose face there are five gashes on the left cheek, as though intended to represent paint marks. The ear stands well out, and at the

[1] Antiquities of Tennessee, p. 180, fig. 80.

back of the head the hair is plaited in a queue and attached to the stem so as to form a space between the queue and the head, by which a string could be attached, if desired. The mouth and teeth are both prominent. The treatment of the head is unique, though the band on the stem appears to connect the pipe with those found in North Carolina, Georgia, and Tennessee, and shows in what varieties these pipes are at times found. The material from which it is made is a compact stalagmite.

Fig. 208, from a Georgia mound, shows in pottery identical treatment with the preceding figure from Tennessee, though the treatment of the head is certainly very highly conventionalized and the queue and rim of the bowl, as well as the face marks, whether paint or tattoo, and the teeth would hardly be recognized were it not for the Tennessee stone specimens furnishing a guide with which the Georgia pipe may be compared. In fact the analogy in pipes from Georgia and Tennessee is often observed.

Squier and Davis figure a clay pipe found opposite the mouth of the Hocking River, in Virginia, "where there are abundant traces of an ancient people in the form of embankments, mounds, etc.,"[1] which represents a head of a person whose hair appears to be done up more in the manner of the whites than that of the natives, and Jones also figures one form which has the band upon the stem.[2]

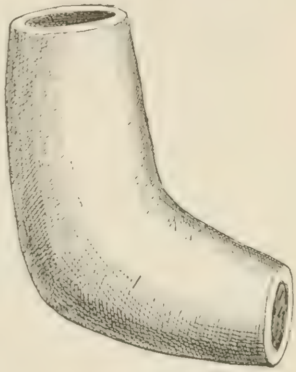


Fig. 209.
STONE PIPE.
Jackson County, Missouri.
Cat. No. 174014, U.S.N.M.
Collected by James Rodman.

SOME UNIQUE TYPES.

Fig. 209 is a dark-green speckled serpentine pipe $2\frac{1}{2}$ inches in greatest diameter, with a width of $1\frac{1}{2}$ inches, being a surface find from Jackson County, Missouri, and collected by Dr. James Rodman, of Kentucky. It is of an attractive green and white color, having been smoothed with unusual care, the outer surface having all tool marks obliterated. The bowl and stem openings, each of five-eighths of an inch in uniform diameter to their point of intersection in the center of the specimen, have been bored by means of a metal tubular drill. In shape, material, and character of finish this pipe is unique.

A very remarkable instance of the distance which Indians will carry material is noted by Dr. Daniel Wilson. "Dr. Kane," he says, "informed me that in coming down the Athabasca River, when near its source in the Rocky Mountains, he observed his Assinaboine guides select the favorite bluish jasper from among the water-worn stones in the bed of the river to carry home for the purpose of pipe manufacture, although they were then fully 500 miles from their

[1] Ancient Monuments of the Mississippi Valley, p. 194, fig. 77.
[2] Antiquities of the Southern Indians, plate XXIV, fig. 3.

lodges,"[1] the reference to jasper being used for pipe making is probably erroneous. The stone referred to was more likely a serpentine. The difficulty of boring jasper would be very great without corundum or sand of similar hardness, and when drilled its hardness would probably cause it to break from heating on being smoked. In the several thousand pipes in the U. S. National Museum collections the writer does not recall having encountered a single one of jasper, nor does he recall such a one being elsewhere described.

Fig. 210.

WOOD AND LEAD PIPE.

Rhode Island.

Cat. No. 10080, U.S.N.M. Collected by George Gibbs.

This pipe of wood from Rhode Island (fig. 210), collected by Mr. George Gibbs, is artistically finished, being artistically carved in the round with more than ordinary skill. It is 3 inches long, 4 inches high, with a width of 1⅝ inches. To prevent the bowl, which appears to be made of laurel or briar root, from burning out, it has been lined with lead, which has been built up to prevent the bowl from burning through. This lead has been subsequently rubbed down so as to make a uniform surface. The figure is nude, represented as though sitting with one leg on each side of the stem, the elbows on the knees, and the head resting in the hands, as though the individual were in a brown study. While anatomically this figure may be open to criticism, the pose is decidedly graceful and the manipulation or tool work far from that of a novice.

Mr. David Boyle has figured two most interesting stone pipes found in Ontario, which are nearly 5 and 3 inches long, respectively, one made of a limestone and the other of a soapstone, the one from Ontario County and the other from Durham County, each of which is made in the shape of a turtle, executed with skill to the minutest detail of carving.[2]

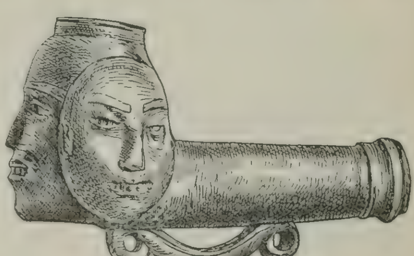


Fig. 211.

PORTRAIT PIPE.

San Salvador, Central America.

After photograph of Andrew E. Douglass.

Mr. Andrew E. Douglass has in his collection (fig. 211) a most interesting and highly ornate portrait pipe, which is said to have been found deep in a mine in San Salvador, Central America, which is of the most unique character in the writer's experience, it being made from a dark-blue or gray slate, similar to that worked on Queen Charlottes Island, in the Pacific. There are upon the

[1] Prehistoric Man, I, p. 391, London, 1876.

[2] Appendix to the Annual Report of the Minister of Education of Ontario, 1896-97, pp. 52, 53.

bowl three human faces, none of which face the smoker, those on the sides strongly resembling masks. The pipe is 4½ inches long, with a height of 2 inches. On the underside of the stem there is a scroll-like handle, carved from the stone, slightly curved and rolling at each end, where it is attached to the stem, while around the end of the stem itself there is a band such as is often encountered on the Southern Atlantic coast of the United States, but unknown on the Pacific in the writer's experience. This scroll-like handle is carved by one familiar with heavy metal and was said to be found 14 feet from the surface of a mine worked at the time of the conquest.[1] The face of this pipe on the far side of the bowl has a mustache. The pipe has been bored by means of a pointed steel tool. The writer was also shown by Mr. Douglass a photograph of a somewhat similar pipe which is in the Christie collection of the British Museum, which is said to have come from British Columbia. Another of this character, having only one head upon it, has a beard on the face, and is said to come from Pembina Red River of the North. These several specimens come from widely separate areas, though it appears to the writer that all of them originally started from the blue slate quarries out of which the Indians of Queen Charlottes Islands work so many really beautiful objects. Just as the natives of the northwestern coast of America at the present day work pipes into many grotesque forms for the purpose of attracting the white man's fancy and consequently his money, so the writer imagines that the early European on the continent, along the Atlantic coast and the interior rivers and lakes, carved of the steatites and chlorites and indurated clays pipes of a character for which the Indian would pay the largest price in furs, and eventually traded to the Indian tools of hard metal fit to saw and scrape the softer stones suitable for tobacco pipes, a practice which the Indian himself would follow, and we know from more than one source that he did imitate the white man's design.

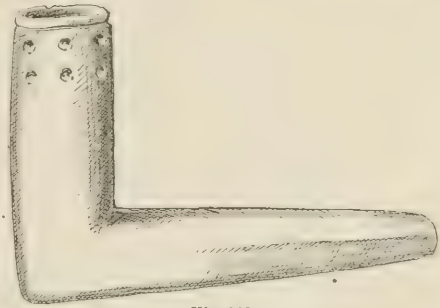


Fig. 212.

RECTANGULAR STONE PIPE.

Indiana.

Cat. No. 45587, U.S.N.M. Collected by H. T. Woodman.

Fig. 212 is a rectangular pipe made of a dark-green serpentine. It is 3¼ inches long by 2¼ inches in height, found in Indiana, collected by Mr. H. T. Woodman. It is smoothed over its whole surface and ornamented by a double row of small holes bored into the bowl near the top and has a slight incision around the exterior of the rim encircling the bowl. This specimen is sufficiently distinct from other specimens to entitle it to a place by itself, though its age is probably recent.

[1] American Antiquarian, November, 1889, p. 349.

ATLANTIC COAST PIPES.

A most interesting type of pipe is found in the shell heaps south of the Hudson, certainly as far as Maryland, and perhaps yet farther, which appear related to certain types found in North Carolina, Georgia, and Tennessee, through a territory which at the first advent of the whites appears to have been inhabited by Algonquin, Siouan, and Iroquoian tribes, a more critical study of which will possibly connect them with pipes of the St. Lawrence River regions, especially those pipes with flaring bowls resembling brass hunting horns. There is an almost insurmountable difficulty in the study of any primitive handiwork of the American Indians, owing to the meager records preserved by those who came in first contact with them. From historical data there is room to suspect that many expeditions had reached the shores of what is now the United States and Canada between the years 1535 and 1630 of which we have no records. The extent of their trade may possibly not have been far from the sight of the ocean, though from the first arrival of the colonists, Spanish, French, English, Dutch, or Swede, the trapper and trader sought the wilderness for skins. Of these expeditions little is known, for none of them, if successful, would inform his acquaintance of the rich fields of sport or trade, but saved his knowledge for future profit to himself. Throughout the early period the most bloodthirsty feuds were engendered between the tribes by French, Spanish, and English in their efforts to retain the trade of a tribe, or confederacy, or to divert it from their rivals. The proximity of the Atlantic coast to the tribes west of the Alleghenies was offset by the water transportation and short carries of the French from the St. Lawrence, who did not hesitate, it has been said, to publish false maps of the interior for the purpose of misleading the English. Lawson says in 1700, and with full knowledge of the conditions then existing, "'Tis a great misfortune that most of our travelers, who go to this vast continent in America, are persons of the meaner sort, and generally, of a very slender education; who being hired by the merchants to trade amongst the Indians, in which voyages they often spend several years, are yet, at their return incapable of giving any reasonable account of what they met withal in those remote parts; though the country abounds with curiosities worthy of a nice observation."[1]

Notwithstanding many interesting papers of those who imagine they observe evidences in implements made by the American Indian indicating left-handedness, Lawson observes of them, "When they cut with a knife the edge is toward them, whereas, we always cut and whittle from us. Nor did I ever see one of them left-handed."[2]

[1] John Lawson, The History of Carolina, Preface, p. v, London, 1714, reprint, Raleigh, 1860.

[2] Idem, p. 330.

We may imagine the process of drilling these long stemmed pipes, if made by the natives, by what this writer says of their using the straight shaft as a boring tool in perforating shells. "Thus," he says, "they roll continually on their thighs with their right hand, holding the bit of shell with their left, so in time they drill a hole quite through it, which is very tedious work; but especially in making their Ronoak, four of which will scarce make one length of wampum, the work was performed with a nail stuck in a cane or reed."[1]

He further says of their work: "At spare hours the women make baskets and mats to lie upon, and those that are not extraordinary hunters make bowls, dishes, and spoons of gum wood and the tulip tree; others, when they find a vein of white clay fit for their purpose, make tobacco pipes, all which are often transported to other Indians that perhaps have greater plenty of deer and game; so they buy with these manufactures the raw skins, which they dress afterwards."[2]

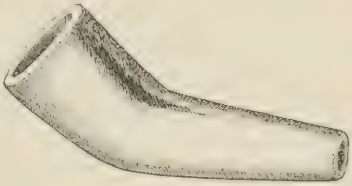


Fig. 213.

ATLANTIC COAST PIPE.

Monroe County, Tennessee.

Cat. No. 115546, U.S.N.M. Collected by J. W. Emmert.

An almost black chlorite pipe (fig. 213), $3\frac{1}{4}$ inches long, from Monroe County, Tennessee, collected by Mr. J. W. Emmert, has a uniformly smooth surface. The walls of both bowl and stem are each extremely thin, scarcely more than one-sixteenth of an inch; the stem hole has a conoidal opening decreasing in the 2 inches of its length from one-half to one-fourth of an inch in diameter. There are several pipes in the U. S. National Museum collection of this character from the Lenoir burial place in North Carolina, the perforations in the bowls and stems of which appear to indicate the use of metal tools. A pipe of this character was found in a mound on New River, southwestern Virginia, by Mr. H. H. Flanagan. It is made of pottery, which has upon its surface those small indentations, or mill marks, noticeable on the English molded trade pipe. These indentations show, however, that they have been incised since the baking of the pipe and consequent hardening of the clay.

A stone pipe, having all the characteristics of the English pipes of commerce, made from a material of light-brown color, was recently found on the Potomac River, near Shepherdstown, by Mr. Newton D. Sprecher. The same type is also found in the Lenoir burial place, made of a hard-burned black pottery.

Fig. 214, collected by Mr. John P. Rogan, is a pottery pipe, 4 inches long, decreasing in size from the bowl to the end of the stem. There is no indication of any wear caused by the teeth. The openings of the stems of pipes of this character are of a size indicating that they were

[1] John Lawson, The History of Carolina, p. 316, London, 1714, reprint, Raleigh, 1860.

[2] Idem, p. 338, 1860.

smoked with a stem of different material, the stem opening decreasing from the orifice, as is noted in the tubular pipes from California, which had short bird-bone stems held in with asphaltum. Were these pipes smoked without other stems it is probable there would be indications of the wear of the teeth, as is at times noticed in the old English pipes, the stems of which are often worn through by the smoker's teeth, though Indian pipes seldom show such wear. This form is said by Dr. Abbott to be also found in New Jersey.[1]

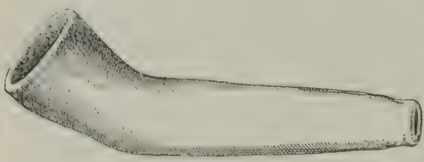


Fig. 214.

ATLANTIC COAST PIPE.

Lenoir, Caldwell County, North Carolina.

Cat. No. 82839, U.S.N.M. Collected by John P. Rogan.

A pipe of pottery from Fort Defiance, the Lenoir burial place, North Carolina, collected by Mr. J. P. Rogan (fig. 215), has no tempering material mixed with the clay from which it is made, a very noticeable occurrence in this type of pipes, and it is a matter deserving of particular attention to see if other objects were made of such earthenware. The bowl of this pipe, which flares out more than any of the preceding specimens, has walls at least one-fourth of an inch thick. This pipe is quite rude in its finish, the marks of the tools with which it was made being still perfectly distinct, the specimen being in outline not distantly related either to the tubular pipe or to the pipes used by the English in trade.

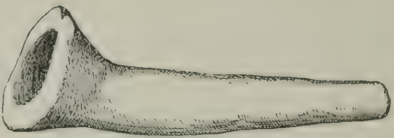


Fig. 215.

ATLANTIC COAST PIPE.

Caldwell County, North Carolina.

Cat. No. 83043, U.S.N.M. Collected by J. P. Rogan.

Fig. 216, of steatite, was found in a mound in Caldwell County, North Carolina, and was collected by Mr. J. P. Rogan. Its color is a light pink, the specimen being smoothed over its whole surface. The stone of which this pipe is made is extremely soft, and had it been held between the teeth of the smoker it is scarcely possible that there would not be marks on its stem, which, however, is perfectly smooth. The characteristics of this specimen are similar to those of pottery pipes, even in the thinness of the walls of both bowl and stem, which are scarcely if at all in excess of a sixteenth of an inch thick.

Fig. 216.

ATLANTIC COAST PIPE.

Caldwell County, North Carolina.

Cat. No. 83029, U.S.N.M. Collected by J. P. Rogan.

A soft gray steatite pipe (fig. 217) from a mound in Monroe County,

[1] C. C. Abbott, Stone Age in New Jersey, p. 342, Smithsonian Report, 1875.

North Carolina, collected by Prof. W. C. Kerr, of Raleigh. It is 6½ inches long, worked out with unusual skill, there being embossed on the bowl three circular decorations or eyes, the interiors of which are covered by a network of straight lines crossing each other at different angles, a fourth eye being in the form of a parallelogram with a number of circles, one inside the other. Running up the bowl from the stem there is a tongue shaped decoration which connects this specimen with pipes of the other forms from the same area. The stem at its juncture with the bowl is not more than five-eighths of an inch in diameter, and is covered its entire length with encircling lines about half inch apart, between which are incised ornamental lines running from one circling line to the other in graceful manner.

Fig. 217.

ATLANTIC COAST PIPE.

Monroe County, North Carolina.

Cat. No. 19664, U.S.N.M. Collected by W. C. Kerr.

This type is at times found in the shell heaps of Maryland, made from a bright red or pink pottery of homogeneous texture, which is ornamented in a somewhat similar manner, one of which, resembling the trade pipe, was found on the surface in Wicomico County and is now in the collection of the Maryland Academy of Sciences in Baltimore.

There is in the collection of the University of Pennsylvania a most ornate bright red clay pipe having four groups of crossed lines in separate panels; along the outside of each panel, running up and down the bowl, are a series of dots, all of which at first glance would pass for imitations of the cord marks so commonly seen on Indian pottery. The exact regularity of these dots, two at the side of each line of the panel, cause Mr. Stewart Culin to suggest that these panels are intended to be employed after the manner of the wampum belt, which appears to the writer to be possible.

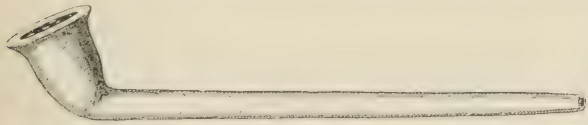


Fig. 218.

ATLANTIC COAST PIPE.

Caldwell County, North Carolina.

Cat. No. 82835, U.S.N.M. Collected by J. P. Rogan.

A dark red, almost purple, specimen (fig. 218) of chlorite was found in a mound in Caldwell County, North Carolina, collected by Mr. J. P. Rogan. This delicately finished pipe is 11 inches long and from the base of the stem to the top of the bowl is scarcely 1¾ inches in height, with a diameter across the exterior of the bowl of 1⅝ inches; the stem is 9¼ inches and has a diameter at its juncture with the bowl very

slightly in excess of half an inch, which gradually decreases to one-fourth of an inch at the point, the whole stem being bored by means of a solid drill. The bowl has a flaring rim, and at the base of the stem a tongue is worked out of the stone in low relief on the bowl, reaching two-thirds of the way to the top as though made in imitation of a similar specimen of metal.

Though the tool marks are carefully obliterated from the stem, there is visible on the bowl a number of fine, straight, parallel lines, which suggest the probable use of a metal file. When the length of this pipe is considered it will readily be perceived how delicate was the manipulation of the tool not to break the stem in boring it. The length and delicacy of the stem would suggest that such an implement would be owned by individuals having sedentary habits, for otherwise its length of stem would make it liable to break in being carried from point to point. On this pipe, as has so often been observed of others, the mark of the teeth is not noticeable.

The writer's attention has been called to two pipes in the Essex

Fig. 219.

ATLANTIC COAST PIPE.

Essex County, Massachusetts.

Peabody Academy of Sciences.

County collection of the Peabody Academy of Science, in Salem, Massachusetts, very much of the character of the last figure, except, possibly, that the edge of the bowl does not flare out in so pronounced a manner. These pipes are about 6 inches long, are made of soapstone, and were found in Indian graves, which, from their great similarity to the southern specimens of the same type (fig. 219), the writer would be inclined to consider of a date subsequent to English settlement in the country.

SOUTHERN MOUND PIPES.

Fig. 220 is a dark green serpentine pipe, from Monroe County, Tennessee, collected by Mr. J. W. Emmert, which, because of the difference in the size of its stem opening and the enlarged band on the end of the stem, necessitates its being placed in a separate class, though the tongue-like appearance on the bowl shows it to be related to the pipes which we have described with similar decoration. Such pipes are evidently intended to be smoked by means of separate stems, and while the tongue would indicate a metal prototype, the band or enlargement of the stem would suggest it was copied from a plastic model. Pipes of this type

are substantially made, and their surfaces are carefully ground, this specimen being 3 inches long.

Fig. 221 is a dark green chlorite pipe collected by Mr. J. W. Emmert in Loudon County, Tennessee. It retains the type characteristics of tongue and band, and in addition there is a disk carved in relief on the base of the bowl, which is almost convincing that it is in imitation of a copper or other metal original, as the embossed disks on many of these pipes are identical with hammered metal, which is not unlike very similar figures observed on sheet copper found in mounds by Mr. Clarence B. Moore on the St. Johns River, Florida.[1]

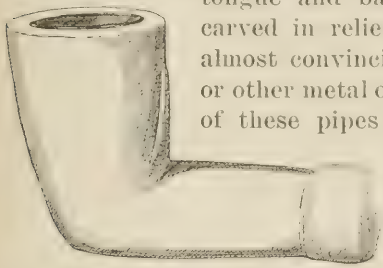


Fig. 220.

SOUTHERN MOUND PIPE.

Monroe County, Tennessee.

Cat. No. 115550, U.S.N.M.

In the Douglass collection there are a number of pipes of this type, one of which has an eye-like figure cut into the bowl. They are made of steatite, one of which, 14 inches long, was found in Sevier County, Tennessee. This type is also found in the Etowah Mound, Bartow County, Georgia, and other specimens in the U. S. National Museum have been found in other parts of these States and in South Carolina. On the last pipe figured the file mark appears again in evidence.

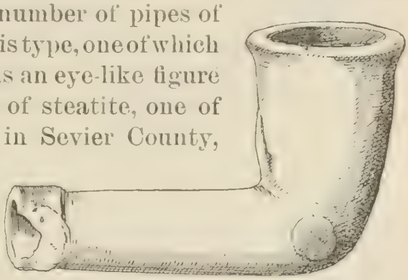


Fig. 221.

SOUTHERN MOUND PIPE.

Loudon County, Tennessee.

Cat. No. 116009, U.S.N.M. Collected by J. W. Emmert.

The embossed circles vary in number from two to ten or more, and the specimens of this type from the Lenoir burial place in North Carolina and those from Loudon County, Tennessee, leave little room to doubt that both come from the same quarry.

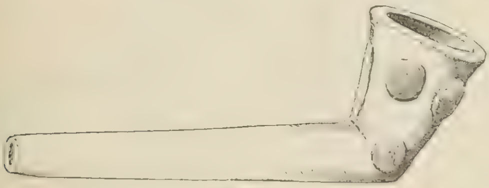


Fig. 222.

SOUTHERN MOUND PIPE.

Monroe County, Tennessee.

Cat. No. 115552, U.S.N.M. Collected by J. W. Emmert.

Fig. 222 is a chlorite pipe from Toco Mound, Monroe County, Tennessee, collected by Mr. J. W. Emmert. It is 5 inches long and $1\frac{3}{4}$ inches high, and has six of the embossed disks upon the bowl. The usual band on the stem, however, is absent; nor are there on this specimen any file marks distinguishable.

Fig. 223 is a heavy, large-bowled, dark green pipe of steatite from Ashe County, North Carolina, which was collected by Mr. W. C.

[1] Clarence B. Moore, Certain Sand Mounds on St. Johns River, Florida, pp. 140, 141.

Jirdonston, and, though the type characteristics are accurate in a measure, the specimen has an extremely modern appearance, file marks being quite distinguishable over the entire surface. The bowl is carefully bored to a depth of 1$\frac{3}{16}$ inches, with an opening 1⅛ inches and of uniform diameter. Even the band on the stem has here become perceptibly modified.

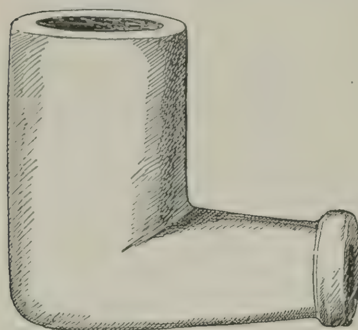


Fig. 223.

SOUTHERN MOUND PIPE.

Ashe County, North Carolina.

Cat. No. 98608, U.S.N.M. Collected by W. C. Jirdonston.

Fig. 224 is a diminutive chlorite pipe from Caldwell County, North Carolina, collected by Mr. J. P. Rogan in the R. T. Lenoir burial place. It has a length of 1⅝ inches, with a height of an inch, and is in every way a symmetrical, though diminutive, specimen. The embossed eyes, while as distinct and in as high relief from the general surface as are the others, are so ground as to leave them in separate groups of three on a side. They are so rounded down to the surrounding surface by friction on the side of the disks as gradually to lose their identity on their edges.

In general characteristics fig. 225 is true to the type—though it is made of pottery—and was found in the Lenoir burial place, Caldwell County, North Carolina, by Mr. J. P. Rogan. It is 2 inches long. The clay appears to be mixed with a large proportion of mica for tempering. There are three disks in this instance on a side, while over the stem where it joins the bowl there is an enlargement, but neither band nor tongue. The similarities in the embossed circles on this pipe and those made of stone are most striking and unmistakable. The rim of the bowl is more pronounced than in any of the stone specimens, and into its outer edge eight notches are cut at intervals.

Fig. 224.

SOUTHERN MOUND PIPE.

Caldwell County, North Carolina.

Cat. No. 83046, U.S.N.M. Collected by J. P. Rogan.

There is in the Douglass collection a pottery pipe of this type from Mazeppa, Georgia, upon the stem of which appears the band, which, as observed in the figures illustrated, is not a constant occurrence, though quite common in this type.

Mr. Clarence B. Moore, in his recent exploration on the Georgia coast, illustrates an earthenware pipe (fig. 226) with the stem band, upon the bowl of which are a number of these disks with flattened peripheries in high relief, and from a point just below the rim of the bowl to the stem there is a loop of pottery, as in the Tennessee specimen figured, which appears to connect the two.[1]

[1] Certain Aboriginal Mounds on the Georgia Coast, fig. 21, Philadelphia, 1897.

A plain bowl pipe from Tennessee, with quite a short stem, in the Douglass collection, has a similar loop.

Fig. 227, also a pottery specimen, from the Etowah Mound, Bartow County, Georgia, collected by Dr. Roland Steiner, is made from a brick-red pottery, apparently containing no tempering. The type is the same always, though in this specimen the disks are very pronounced and the edge of the bowl is flared; encircling the bowl are a row of six of these knobs with rounded surfaces, below which are four others. The stem is partly broken, though enough remains to show that it flared, as does the bowl.

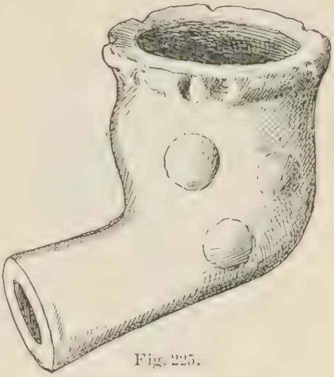


Fig. 225.

SOUTHERN MOUND PIPE.

Caldwell County, North Carolina.

Cat. No. 83048, U.S.N.M. Collected by J. P. Rogan.

Fig. 228 is also of pottery, found by Mr. J. P. Rogan in Bradley County, Tennessee. There is a difference between this pipe and the others, though bowl and stem hold relative proportions in conformity to the type; the pottery is red and the bowl flares somewhat, though the stem is shorter than is usually the case, the bottom of the bowl resembling the curve of the human knee.

Fig. 229 is in many respects similar in its characteristics to this type. This pipe is from Loudon County, Tennessee, and is made from a light-red clay, with very little admixture of tempering material. The bowl has a pronounced flare, and the specimen is 3 inches long, the top of the bowl being 2 inches wide. A peculiarity of the bowl of this pipe is that it is rectangular in its opening, as though a square plug had been driven into the clay while it was yet in its plastic condition. It was found by Mr. J. W. Emmert.

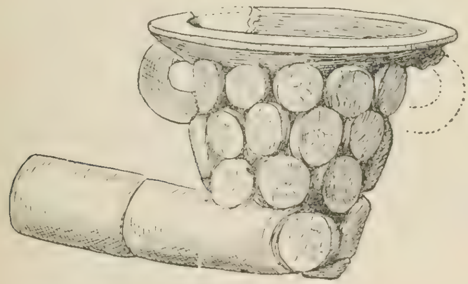


Fig. 226.

SOUTHERN MOUND PIPE.

After Clarence B. Moore. Certain Aboriginal Mounds on the Georgia coast, fig. 21.

Fig. 230 is made of an unusually hard-burned pottery, which was found in the Etowah Mound, Bartow County, Georgia, being about 3 inches long. The resemblance to the human leg in this figure is striking, the knee being slightly bent, the thigh forming the bowl, as the lower part of the leg does the stem, and above and below the supposed knee are a number of incised lines. As in the tubular pipe from the ruin of Sikyatki, New Mexico, bowl and stem each flare gradually. A pipe of similar form was found in the Lenoir burial place, though without the incised lines, and is now in the collection of the U. S. National Museum.

A very similar pipe to this one made of light clay found in Georgia is in the collection of the University of Pennsylvania.

An elaborate artistic pottery pipe belonging to the Steiner collection is on deposit in the U. S. National Museum. Fig. 231 from the Etowah Mound in Bartow County, Georgia, is in quite a fragmentary condition, as both bowl and stem are badly broken, yet sufficient remains to leave no doubt of its belonging to the type under discussion. The bowl is formed at the neck of a long-billed bird and is of the ordinary Indian pot form, excepting the prolongation of the upper rim when it reenforces the bird's beak; there are encircling the bowl two rows of square pyramidal facets, one above the other; the bird's eye is neatly incised, the curve of the head being distinct and the opening of the beak being represented by a straight line cut into the pottery, the whole having a pleasing individuality and representing an originality contrasting strongly with ordinary Indian art, though somewhat similar to pipes found in Cayuga County, New York.

Fig. 227.

SOUTHERN MOUND PIPE.

Etowah Mound, Bartow County, Georgia.

Steiner collection. Deposited in U. S. National Museum.

Fig. 228.

SOUTHERN MOUND PIPE.

Bradley County, Tennessee.

Cat. No. 116341, U.S.N.M. Collected by J. P. Rogan.

Another specimen from the Etowah Mound in the Steiner collection (fig. 232) shows a different treatment of both the bowl and the bird's beak, the specimen being made of a light yellow pottery. The flaring sides of the rim of the bowl, as well as the whole form of the same, is strikingly similar to the vessels held clasped in the arms of human figures, a pottery specimen of which was found in this mound, and another in Tennessee. The beak here is opened, in which the bowl is modeled, the eye being smaller, though incised in a similar manner to that of the last figure; the band of the stem has more of a bead-like exterior than with any of the other pipes of this type.

Fig. 229.

SOUTHERN MOUND PIPE.

Loudon County, Tennessee.

Cat. No. 6762, U.S.N.M. Collected by J. W. Emmert.

A typical pipe of this kind made also of pottery from Loudon County, Tennessee, collected by Mr. J. W. Emmert (fig. 233), shows the bird's

beak holding a plain bowl of the Indian form, the eye being represented by a rounded depression cut into the earthenware on either side of the head. Were it not for the other specimens figured, one might claim that the bird was not distinguishable as a definite ornamentation. A noticeable departure from the beak characteristics of this

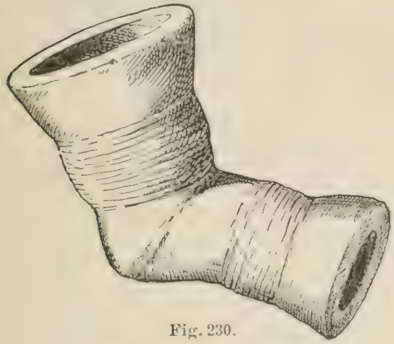


Fig. 230.

SOUTHERN MOUND PIPE.

Etowah Mound, Bartow County, Georgia.

Steiner collection. Deposited in U. S. National Museum.

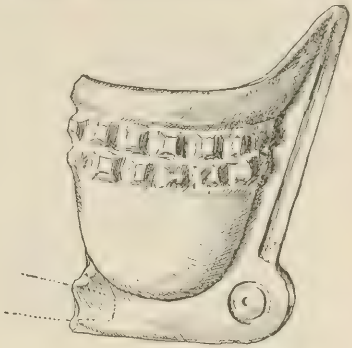


Fig. 231.

SOUTHERN MOUND PIPE.

Etowah Mound, Bartow County, Georgia.

Steiner collection. Deposited in U. S. National Museum.

type appears in an oblong depression at the base of the bowl under its stem where the pottery is cut out one-half the thickness of the same, and would be inexplicable were it not for a specimen from Camden County, Georgia. The only other treatment of the figures of clay pipes in any way approaching or resembling these birds with distended jaws, or with the closed beak, is in the pipe from Cayuga County, New York,

Fig. 232.

SOUTHERN MOUND PIPE.

Etowah Mound, Bartow County, Georgia.

Steiner collection. Deposited in U. S. National Museum.

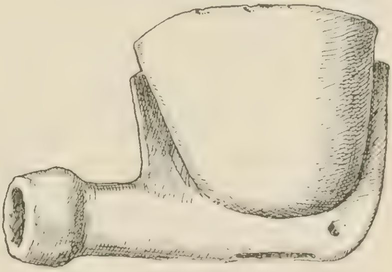


Fig. 233.

SOUTHERN MOUND PIPE.

Loudon County, Tennessee.

Cat. No. 6822, U.S.N.M. Collected by J. W. Emmert.

of the Iroquoian type, where the bird's beak extends far above the rim of the bowl, the bowl itself apparently being the pouch of the bird. While the treatment of the northern and the southern pipes is so dissimilar, there appears to the writer to be sufficient analogy to attribute a like artistic development to the persons making the one and the other.

Fig. 234 represents a pipe from Camden County, Georgia, collected by Mr. G. R. Floyd. It belongs also to the type we have been discussing, though it presents an entirely new art concept. The specimen is of pottery; the bowl with its flaring rim is severe in its simplicity, the band on the stem remaining constant through most of the specimens of the type, though even this rule has its exceptions, and the bird's beak has disappeared from the bowl, though it reappears in the depression in the base of the stem under the bowl, in which a pottery ball yet remains adhering as when first modeled, apparently establishing quite an interesting conventional treatment of the beak of a bird. There is another specimen of this type from Hardin's farm in Blount County, Tennessee, slightly larger than the pipe figured from the U. S. National Museum collection.

Fig. 234.

SOUTHERN MOUND PIPE.

Camden County, Georgia.

Cat. No. 10008, U.S.N.M. Collected by G. R. Floyd.

An extremely interesting specimen of this type of pipe is that represented in fig. 235, which was collected by Mr. Clarence B. Moore during the winter of 1897–98, in a mound on the Savannah River. It, like most pipes of this type, is made of clay. Opinions will probably differ as to the creature intended to be represented; looking at the side view, one could argue that a bird or frog was imitated, while regarding the face view, it looks like some indefinible monster. The type, however, is distinct, and the locality in which it was discovered is well within the geographical area of which pipes of this class are found. This specimen is the most elaborate and in many respects one of the most interesting pipes with which the writer is acquainted.

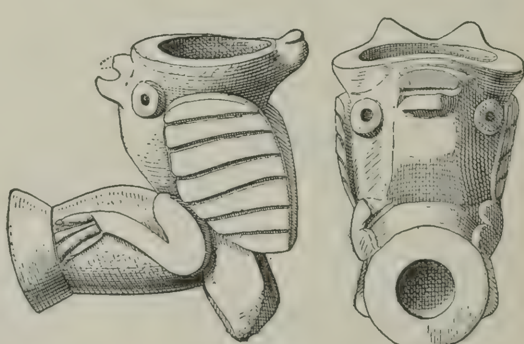


Fig. 235.

SOUTHERN MOUND PIPE.

Side and front view.

After Clarence B. Moore. Certain Aboriginal Mounds of the Savannah River, Georgia, p. 170.

Fig. 236, from Loudon County, Tennessee, collected by Mr. J. W. Emmert, is made of a red pottery, without apparent tempering, and shows a somewhat different character of ornamentation in two serrated ridges, one running up in front of the bowl and the other from the stem up to the rim, while two serrated rows of ornamentation encircle

the curved bowl, making a graceful whole. The bowls of pipes of this type vary from three-fourths of an inch to an inch in interior diameter, while the stem hole is ordinarily about three-eighths of an inch.

A pottery pipe from Nacooche, Georgia, collected by Mr. J. H. Nichols (fig. 237), is ornamented with cross furrows, leaving the whole surface of the bowl covered with low, rectangular pyramids, the short stem being left perfectly plain, whereas the band on the stem is higher than is commonly the case, being shouldered on the inner side and rounded off to the stem opening, its periphery being serrated. This serrated stem band and the pyramidal ornaments all appear to have been cut out of the pottery subsequent to its baking. Upon the rim of the bowl, with its back to the smoker, there is perched, gracefully, a dwarf-like bird form, the beak, eyes, ears, and tail of which are striking in their prominence; and while the resemblance in anatomical detail is but a caricature, one is forced almost to see an effort to shape a likeness to the little screech owl of our woods. As a whole, this pipe must be considered as highly specialized and exhibiting artistic merit.

Fig. 236.

SOUTHERN MOUND PIPE.

Loudon County, Tennessee.

Cat. No. 115958, U.S.N.M. Collected by J. W. Emmert.

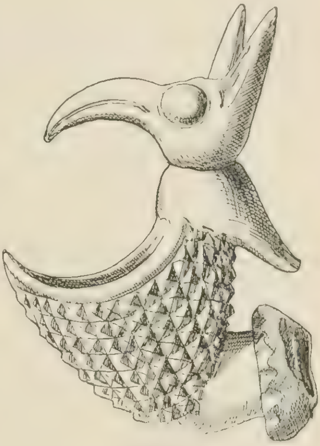


Fig. 237.

SOUTHERN MOUND PIPE.

Nacooche, Georgia.

Cat. No. 31569, U.S.N.M. Collected by J. H. Nichols.

Fig. 238 is a pipe found in the inclosure adjoining the Etowah Mound, and is made of a well-burned dark pottery. It is a most graceful pipe, decorated with six leaves, three on either side of the bowl, connected at their base to a stem, and evidently representing the tobacco plant, the stem of the plant forming the mold mark, showing undoubted European manufacture. The general principle involved in the technique of this pipe may yet be distinctly traced in pipes still made in Marseilles, France, and in Guda, Holland, upon the bases of which the tobacco leaves and bird's beak are grouped. These pipes show such artistic

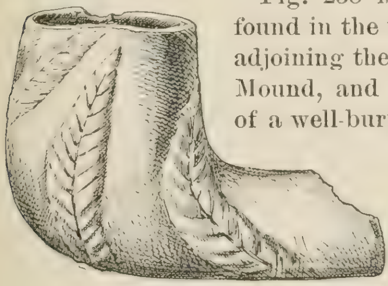


Fig. 238.

MOUND TYPE OF MOLDED POTTERY PIPE.

Etowah Mound, Georgia.

Steiner collection. Deposited in U. S. National Museum.

merit, and those of stone and pottery are so similar, the stone specimens often showing the file mark, as to impress one with the belief that the art concept of the whole series is that of the whites, even though it should be contended that the manipulation were that of Indians. The resemblance surviving among French and Dutch pipes of the present day would appear to indicate French origin rather than Dutch, especially when the treatment of the Cayuga clay pipes having bird beaks are compared with the Southern specimens. If this surmise be correct, then these pipes would appear to be contemporaneous with the early French settlements in the Carolinas.

The French family names of the Carolinas attest the nationality of its settlers in the colonial period. Twenty years prior to the advent of Raleigh, Laudonierre, in 1562, was sent by Admiral Coligny, under a patent of Charles IX, to make a settlement in America, Ribault having planted a colony of French at Port Royal Bay. These people were all massacred by the Spanish in 1565, though a few years later, in 1579, we find the French Huguenots and Walloons settling in the Dutch Republic.[1] Many of them settled in Acadia, and because of the edict of Nantes others settled in Carolina, and still others, after a short residence in Canada and New York, went south because of the climate being more like that of France.[2]

When Nova Scotia surrendered to the British after the treaty of Utrecht in 1763, many Acadians refused to take the oath of allegiance, and 1500 were at one time transported to Charleston, South Carolina.[3]

In the French colonies young women recruits were enrolled in France and came to people America,[4] just as the "redemptorists" were brought to America, and whose time was sold to reimburse the companies of shippers who imported them under contract to be paid back by their labor.

The earliest colonists "exported furs and peltries, much of which was procured from the Indians, which gave rise to a brisk trade between them and the settlers in the way of barter."[5]

Anthony Park, one of the first settlers of the back country, who then lived in the Newberry district (1758), traveled a few hundred miles among the Indians west of the Allegheny Mountains. He found several white men, chiefly Irish or Scotch, who said they had lived as much as twenty years among the Indians, a few from forty to fifty, and one sixty years, who must have taken up his residence 400 miles west of Charleston before the close of the seventeenth century,[6] and these are the people who would naturally introduce ornamental pipes among the natives as articles of trade, having no source of supply other than the country afforded.

[1] Charles W. Biard, History of Huguenot Emigration to America, I, p. 151, New York.
[2] Idem, I, pp. 7, 9.
[3] David Ramsay, History of South Carolina, I, p. 15, Charleston, 1809.
[4] M. Bossu, Nouveaux Voyages aux Indes Occidentales, I, p. 23, Paris, 1768.
[5] David Ramsay, History of South Carolina, II, p. 233.
[6] Idem, I, p. 208, note.

Tobacco had a superstitious value, according to Dr. Everard, who in 1659 said: "The devil was much afraid of it, as I was informed by one born in England of Spanish parentage."[1]

Lawson, in his history of Carolina, says: "The women smoke tobacco; they have pipes whose heads are cut out of stone and will hold an ounce of tobacco and some much less."[2]

The writer has seen a clay pipe from Georgia, the bowl of which would readily hold an ounce of tobacco. That the Steiner pipes, which were found in and near the Etowah Mound, Georgia, and those found in the Lenoir burial place, North Carolina, as well as certain specimens found elsewhere in Georgia and Tennessee, whether made of stone or pottery, were made by the same people there does not appear reason to doubt. From their striking resemblance to each other they must have a common origin.

Gen. Gates P. Thruston, speaking of pipestems, says they are of uniform diameter, "for a closely-fitting reed or cane stem probably belongs to a type comparatively modern, as this appears to be the usual stem hole drilled by the historic Indians."[3]

Bartram, about 1773, who was well acquainted with the natives of the region we have been discussing, says: "As to mechanic arts or manufactures, they have scarcely anything worth observation. The men perform nothing except erecting their mean habitations, forming their canoes, stone pipes, etc."[4]

In 1737 Brickell said of the North Carolina Indians: "In general, they are great smokers of tobacco (in their language 'uppowoc'), which they tell us they had before the Europeans made any discoveries in that country, and although they are great smokers, yet they are never known to chew or make it into snuff, but will very freely take a pinch of snuff out of a European's box."[5]

The color of the chlorite of which many of these pipes are made indicates their form to be derived from copper originals. The embossed eyes are identical with what would be produced by hammering thin sheet copper, though there may have been and probably were wooden pipes of the different kinds which have been used in different parts of the continent.

Bartram describes the Cherokee smoking custom of a century ago in the Southern States. He says: "After partaking of this simple but healthy and liberal collation and the dishes cleared off, tobacco and pipes were brought and the chief, filling one of them, whose stem, about 4 feet long, was sheathed in a beautiful speckled snake's skin and adorned with feathers and strings of wampum, lights it and smokes a few whiffs, puffing the smoke first toward the sun, then to

[1] Dr. Everard, Panacea, or the Universal Medicine, Dedicatory, London, 1659.

[2] History of North Carolina, p. 56.

[3] Antiquities of Tennessee, p. 179, Cincinnati, 1890.

[4] William Bartram, Travels through North and South Carolina, Georgia, East and West Florida, p. 511, Dublin, 1793.

[5] John Brickell, The Natural History of North Carolina, p. 287, Dublin, 1737.

the four cardinal points, and lastly over my breast, hands it toward me, which I cheerfully received from him, and we fell into conversation."[1]

Brickell speaks of the heads of these pipes in 1737, which are generally cut out of stone, as being very large, "the shanks whereof are made of hollow cane."[2]

Fig. 239 is an extremely interesting pipe, 3½ inches long and 1¼ inches high, found among a number of bones in digging a well on the bluff at Baden, a northern suburb of St. Louis. With it, about 6 feet below the surface, were found a few arrowheads, indicating that it was an Indian grave. There is evidence in its make-up that shows a curious combination of savage and civilized ingenuity, resembling greatly the combination pipes of the northwest coast. The body of the specimen is composed of a close-grained hard wood, shaped to resemble a bird; the mouth is indicated by an incision on each side of the bill; to represent the eyes a stiff copper wire has been inserted through the head and smoothed even with the surface of the wood; on each side, probably indicating the bird's wings, there is a copper plate, held in position by rivets of the same metal; on the breast of the bird there is let into the wood a plate of copper, fastened by three rivets; the bowl of a typical English trade pipe has been sawed off at the base and inserted tightly into the bird's back and is connected with a stem drilled from the bird's tail, and had to be smoked with a separate stem. This pipe is now in the Douglass collection and has been illustrated by Dr. E. A. Barber.[3]

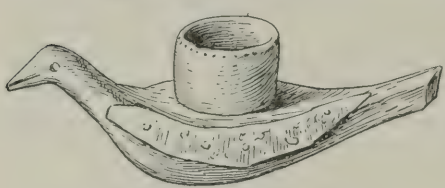


Fig. 239.

COMBINATION CLAY, COPPER, AND WOOD PIPE.

St. Louis, Missouri.

A. E. Douglass collection, New York City.

In a somewhat careful search for illustrations of early pipes the results have not been encouraging, one of the earliest writers to figure them being Neander, who, in 1626, illustrates five Persian pipes of forms different from those with which we in America are familiar.[4]

Though this is significant of the wonderful spread in a few years of the use of tobacco.

The Indian in his savage life may be considered peculiar in his offerings of tobacco to allay storms on the water, but was he different in his superstitions to nations of the Old World, where we find that the Roman, according to Gibbon, "deprecated the wrath of the Tiber," nor could he deride the Egyptian who presented his offering to the beneficent genius of the Nile?[5]

[1] William Bartram, Travels through North and South Carolina, Georgia, East and West Florida, p. 349, Dublin, 1793.

[2] John Brickell, The Natural History of North Carolina, p. 287, Dublin, 1737.

[3] American Antiquarian, IV, p. 199.

[4] Johannum Neandrum, Tobacologia, Leyden, 1626.

[5] Edward Gibbon, History of Decline and Fall of the Roman Empire, I, p. 33, Philadelphia, 1804.

SUMMARY.

The rich collections in the U. S. National Museum of pipes of American aborigines, both ancient and modern, suggested this paper. These collections were made from the graves of the Indians, by contributions from public-spirited citizens anxious to preserve records of the natives and of their manners and customs, in addition to which modern specimens have been obtained by purchase from the natives themselves. As a consequence, the genuineness of these pipes may, it is believed, be relied upon. That data necessary to as perfect an understanding as possible should be obtained, specimens in other public museums and in private collections were, so far as possible, separately examined; and when this was not convenient, the desired information was obtained by correspondence. Few if any works have been written on the subject, yet many papers relating to it have been published in magazines and periodicals, and most works referring to early American travels have valuable references to the smoking customs or pipes of the natives. These have all, so far as possible, been consulted and referred to in the progress of the work, which has extended over a period of three years. The writer trusts that but few important references have been overlooked in the mass of literature consulted. It is hoped that the paper includes sufficient material for intelligent criticism of the correctness of opinions expressed, which at times are in conflict with accepted theories.

The subject was begun with no other view than to describe American pipes and smoking customs; the study of the subject has apparently developed information regarding manufacture of pipes, and consequently of other stone, bone, wood, metal, and pottery objects, that it is thought may be of interest in the general investigation of American archæology.

There has been undoubtedly a tendency to attribute great age to all American Indian grave finds, a view apparently contradictory to the results of careful inspection of many of the objects unearthed.

Smoke in some form, even that inhaled and exhaled through tubes, is shown to have been employed in Europe and in Asia from an antiquity long preceding the Christian era. In North America the smoking customs of the natives antedate the arrival of the whites on the continent, and from the similarity both of smoking customs and of the tubes employed in smoking in widely separated parts of the country, there is every indication that they must have prevailed for centuries.

In Europe, Asia, and America, up to a period probably as recent as the first half of the seventeenth century, the employment of smoke appears to have been chiefly, if not entirely, due to its supposed medicinal properties, added to which the Indians used it in their functions of every kind, attaching at times mysterious properties to the plants from which the smoke was produced. The offerings of incense by the Aztecs to the Spanish invaders under Cortez were in many instances similar to the familiar pipe customs of the Indian, and pipes of like

shape are traced from southern Mexico to the British possessions in the north.

From the first advent of the Spanish they appear to have adopted the habit of smoking from the natives, the reasons therefor being that it allayed hunger or fatigue in addition to many medicinal properties which it was said to possess. The French in turn, and for like reason, appear to have adopted its use, and finally the English took to smoking, the example being set by Sir Walter Raleigh, a favorite of the Court of Queen Elizabeth, who herself does not appear to have been averse to use of the weed upon certain occasions. The ravages of the plague during the first three-fourths of the seventeenth century appears to have been one of the chief causes of the rapid spread of the use of tobacco throughout the world, for in an incredibly short space of time the custom had traveled around the earth, again entering America by way of Asia on the west.

So far as appears to be now known, the North American natives at the time of the advent of the whites do not seem to have confined their smoking to the tobacco plant, nor do they do so even at the present day, but employed for that purpose sumac and willow, as well as many other plants, and at times insects and other ingredients, which were supposed to impart desirable odors, as, for example, gums in Mexico and the musk of the muskrat in Maine. There appears to be no evidence that native cultivation could have supplied any great quantity of herbs used in smoking prior to the advent of the whites. After the coming of Spanish, French, and English, cultivation of the tobacco plant probably had much to do with the spread of its use.

To the whites, who for a century or more used tobacco as a panacea for every ailment of the body, must be given the credit, if it be a credit, which many will doubt, of adopting the habit of smoking as a pastime. Owing to the tales of early travelers to America, the smoke of the tobacco plant was considered a specific for all diseases. In a short time the use of the plant came to be viewed as a vice. At first the medical faculty throughout Europe prescribed tobacco to be used in every imaginable way, at various times, from early morning to late night, on empty and on full stomachs, according to the fancy of the one prescribing it. It has been known as the "sacred herb," the "intoxicating plant," the "devil's oracle." Le Jeune in 1633 spoke of the natives using it as "unhappy infidels, who spend their life in smoke and their eternity in flames;" though Dr. Everard, about 1659, the author of a work on the subject entitled, "The panacea, or universal medicine," says: "The devil was much afraid of it, as I was informed by one born in England of Spanish parentage."

The derivation of the word tobacco does not appear to be certain. One of the earliest references to the word, that by Oviedo, referred rather to the pipe than to the plant. The illustration was not contained in the earliest edition of the work, and when it did appear, it

was a bifurcated implement through which smoke was taken by the nostrils, an implement probably used oftener in the nature of a snuffing tube. One of the chief objects of smoking by the natives throughout the Continent was to produce an intoxication, ecstasy, or delirium to the smoker. The names by which tobacco is known in all modern languages appears to be derived either from the American name, "tobacco," or from what appears to be a French or Brazilian name of the plant, "petun."

The profits in Maryland and Virginia on the growth of tobacco were so great during the early period of the English settlements in those colonies as to cause it to be grown to the exclusion of necessary vegetables, the natural result of which on more than one occasion brought about famine and consequent suffering.

The Spanish were the first to use tobacco, then the French, though up to the time of Raleigh's expedition it does not seem to have become a popular weed. After the return to England of the latter expedition, Thomas Hariot, who was a noted botanist and had been sent to America by Raleigh in 1585, reported tobacco as being a plant which preserved the bodies of the natives in health, and that they were not acquainted with many diseases with which the English were afflicted; certainly a powerful argument in favor of the use of a drug at a period when Europe was constantly being visited with Asiatic cholera, a pestilence greatly and deservedly dreaded owing to its ravages.

The use and abuse of tobacco became of such enormous proportions that both church and state felt called upon to curtail its use and cultivation by every means in their power from fear, apparently, that the injurious effects of the use of the plant might effect not only the bodies of the citizens but the revenues of the state as well. To the fathers of the church the use of tobacco appeared to savor of idolatry and its suppression was suggested. King James I wrote his famous "counterblaste to tobacco;" restrictive laws were passed concerning its use; enormous taxes were imposed upon its importation. Popes Urban VIII and Innocent IX issued decrees against its use and Sultan Amuret IV declared smoking a crime punishable with death. Beyond enhancing its value, no effect appears to have been had beyond increasing its use.

In time the value of tobacco was equal, weight for weight, with silver, and the size of the pipe diminished accordingly in Europe, and its effect was apparently felt in America as well.

The mixtures of other plants by the Indians with tobacco has been designated kinnikineck, though this term does not appear to be confined to any specific mixture; the word, however, is commonly employed by the Indians of a large portion of the Continent, and by whites as well.

Pipes, in which tobacco and other herbs have been smoked, are found scattered practically over the whole continent of North America, the

indications being that the custom of smoking prevailed as far north as the British possessions in the east and California in the west.

Pipes are made of an endless variety of substances, such as wood, bone, stone, antler, and metals, and combinations of such materials, though the majority of pipes are made of chlorite or steatite, minerals most suitable in every way for pipe manufacture. Specimens are quite commonly found made from most unsuitable materials, such, for example, as quartzite and bone. A single specimen made from stone coal occurs.

The different types of Indian pipes would appear to be as various as the material from which they were made, though practically all pipes may be classified as belonging to one or other of about a dozen forms, recognizable by the interior dimensions of the bowls and stems and their proportions one to the other. In given cases these proportions would naturally be governed by the supply of smoking materials or of suitable stuff from which to make proper stems. There are some exceptions to the rule, but they occur chiefly among the pipes of the northwest coast of the Continent, where style seems to be governed largely by the taste of the traveling public—the chief purchasers of these pipes. The same cause may be responsible for material, as is notably the case in walrus ivory pipes made and decorated by the Eskimo. The correctness of the classification is proven by the fact that pipes of similar type are found in contiguous areas with remarkable regularity.

One type of pipe alone is found to be common practically to the whole Continent, and this type, a straight tube, is in form the most primitive of any. Where perforated through stone they have been drilled by means of the most primitive drill known, namely, a straight shaft revolved between the palms of the hands or between the hand and the workman's thigh. So far as known to the writer there is scarcely an exception to this rule, the boring of these tubes being started from each end. Both stem and bowl are subsequently enlarged by gouging. On the Pacific coast stems of bone were inserted and held in place by means of bitumen. As the Atlantic coast pipes show many of identical shape, the presumption is that they also had similar stems held in place in like manner or with gum. Again, these tubular pipes are seldom decorated or finished with anything approaching a glass polish until there is found on them carvings in the round, due to modern ideas and methods of work and often the use of metal tools.

There are evidences in the earliest illustrations of the pipe that it was of tubular shape and smoked as one would smoke a straight tube; that is, by throwing back the head and holding the pipe perpendicularly. Again, the use of the tubular pipe in certain aboriginal ceremonies at the most solemn junctures would suggest its greater antiquity over other forms, especially when we find great veneration paid to the tube which is not given to other types of pipe. Certain tra-

ditions also point to the tube as being the most ancient pipe of certain tribes. There is found in the State of Ohio, however, a tube which must not be confounded with the pipes. It is of stone and carries a glass polish, having been bored by means of a tubular metal drill to within an eighth of an inch of a flat end, through the center of which a small hole had been bored into the tube. These tubes have great resonance, and are probably horns and quite modern in make.

On the surfaces of tubular pipes there are observed at times incisions rudely representing animal forms. They appear to be totemic, and the technique of these figures is from an artistic standpoint very inferior to the carvings in the round of later pipes of the tube type, so different, indeed, as to suggest an entirely distinct conception of art—the one purely aboriginal, the other apparently owing its existence not only to the tools, but also to the manipulation of the whites. The more elaborate tubular pipes are usually composed of such stones as chlorite and steatite, both admirably suited to resist the heat engendered in smoking. The great variety observable in the tubular pipes of wood from the Hupa Reservation suggests their being modern, and intended rather to supply tourists' demands than to comply with tribal conventionalisms. There are evidences that the tubular pipe was smoked with the aid of pellets of pottery, or of stone, intended to prevent the escape of tobacco into the smoker's mouth. These pipes, for the reasons given, are presumed to be the most archaic of any in shape, probably continuing with little change until after the whites had become established in the country.

A rectangular pottery pipe made of a glossy ware has been discovered among Mexican ruins, and might raise a question of age were it not that the ware itself is apparently modern, and some of the decorations on pipes of this character almost certainly are. While the pipe appears to belong to the northern part of the continent, records point to the cigarette and the cigar being of pre-Columbian origin in the West India Islands; the pipe being rarely if ever found below Yucatan.

The pipe next to that of tubular form most widely distributed is the bowl pipe, which consists merely of a bowl with a stem hole entering through the wall of the bowl, necessitating that whatever stem was used should be held in position by lashings of leather bound around stem and bowl while wet, which when dried by its contraction would hold stem and bowl together as though made of a single piece. This form, however, is also a modern one, and specimens are consequently often difficult of determination as to age. This type, however, like the tubular pipe, consists usually of stone specimens bored both bowl and stem by means of the solid drill point either of stone, or wood used with dry sand. The size of the stem hole is usually about one-third the diameter of that of the bowl. The exterior shapes of pipes of this type vary from the simplest cube to the most complex animal form, the exteriors at times being inlaid with metal or shell. It is in pipes of this

type that we first encounter basal perforations made for the purpose of attaching bowl to stem by thongs, thus making their loss in the snow less likely. This is an occurrence commonly noticeable in pipes of countries where the winter snows remain long on the ground. Pipes of this type are commonly found throughout the territory adjoining Lakes Ontario and Erie down through Ohio, Indiana, and Kentucky, and into Tennessee and North Carolina, and along the coast up to the British possessions. The territory through which they are found and their often graceful shape would suggest possible French influences.

Among the more elaborate specimens are many carved in imitation of animate figures, though the varied ornamentation encountered in pipes of this type leaves much to be desired in reference to their origin. It is almost certain that some of these pipes have been made with tools of metal, though if so it of course would not be evidence that other specimens were not made with the most primitive tools, which in a majority of instances appears to have been the case. The stems of the pipes were more elaborate if possible than were the bowls, and the significance of pipe-stem decoration was to a great extent decipherable by those familiar with their workmanship. Such decorations often were distinctly ideographic, the color and ornament of the pipe stems being at times significant of peace or war, though often it is known that the ornamentation was simply an evidence of woman's skill in beadwork, plaiting, or embroidery, or of the warrior's excellence in wood carving or combinations of color. The minuteness of description of stem ornamentation encountered in colonial writings, which usually only refer to the color of the pipe as being red, white, or black, is an argument in favor of the plainness of the primitive pipe bowl.

John Smith as early as 1608 speaks of pipes of a size sufficient to beat out the brains of a man, which subsequent authors increased to a size sufficient to beat out the brains of a horse. There is but one pipe of ponderous size which would answer the most extravagant of the above requirements. It is usually carved in imitation of birds or beasts and is the heaviest of all the American pipes. The skill exhibited in making these pipes is astonishing if they are to be attributed to aboriginal art, as many do who are most familiar with the type. Specimens of this variety have been excavated from 15 to 18 feet under the surface, though too much weight should not be given to this fact, as it is well known that the familiar English molded clay pipe of little over two hundred years ago has been repeatedly excavated in London at a depth of 12 or more feet below the surface, and from depths of from 6 to 10 feet in America. A close scrutiny of a number of these pipes fails to develop indications on their surfaces of the employment of the implements of the whites in their manufacture, though they are carved perfectly in the round, and are at times quite highly polished, both accomplishments suggesting white influences. The stone pipes of Indian origin of whatever type rarely show wear of the smokers' teeth

on the stem, even on those having wood stems the marks of teeth are not observable, though in these bird pipes the wear of teeth has been noted. Pipes of this type usually have the bird or beast facing from the smoker. Some of the features of these pipes suggest a close relationship with pipes of the tubular shape. The localities where this pipe is found are in the States of Kentucky, Tennessee, and the extreme western parts of West Virginia, North and South Carolina, and northern Georgia.

The English, French, and Dutch all molded clay pipes which were used in the Indian trade until they came to be known as "trading" or "trade pipes." It does not appear certain where these pipes were first made, whether in England, France, or Holland, archaic specimens having been found in each country. The typical Dutch type being represented in the U. S. National Museum in a specimen found in London and the no less typical English form in a specimen from Holland. French specimens of primitive English type are found having upon their stems stamps showing the lilies of France. An early so-called Roman type of clay pipe was found on the Susquehanna River. Specimens of these pipes have been found in Indian graves along the Atlantic seaboard. Early in the colonial period trade pipes were used as gifts to the Indians from the whites. At first they are mentioned in small numbers, but later they are referred to in treaties by the gross.

Another typical American pipe, though of foreign, probably English, origin, was the metal tomahawk pipe, with a pipe bowl upon one side and a hatchet blade upon the other. The date of this pipe is not certainly known, but it was probably before the time of the American Revolution. Specimens with a spear point have been attributed to the French and those with the rounded battle-ax blade probably belonged to the Spanish. The tribes confederated in the different wars with French and English, and Spanish have moved so far from their original homes as to make it a matter of considerable difficulty to properly locate the origin of the different forms of this pipe. Before leaving the subject of foreign-made pipes it is well to mention the fact that pipes of the trade type made of clay and of metal have been found in various parts of Europe, and they have been alleged to be of great antiquity, though the weight of authority appears to be against attributing to them an age prior to English settlements in America.

The monitor pipe, so called from its resemblance to the war vessel of that name, is found throughout the Atlantic seaboard from South Carolina to the British possessions and from the Atlantic coast, as far west as Kentucky and Tennessee, with rare specimens farther west, as in Michigan and Missouri. As many of these pipes show upon their surfaces file marks and a practical glass polish and from the drilling of their bowls by means of metal drills, one is inclined to attribute to them a post-European date, notwithstanding the fact that they clearly belong to a typical mound type. The bowls of these pipes often show evi-

dences of being enlarged after drilling by gouging with some implement. In contour many of these pipes are as graceful as any found on this Continent, their surface finish being almost perfect while the walls of stem and bowl are finished with a delicacy difficult to improve with any modern tools. These pipes are rarely ornamented with incised lines, and so far as the writer recalls, never have upon their surfaces carved figures.

A rectangular stone pipe, having a bowl at right angles to a long stem and having some creature crawling over the front of the bowl, was made of steatite by means of sawing the stone into shape and gouging the surface and finally completing the object with metal tools has been found along the seaboard, from Pennsylvania to Nova Scotia: and though attributed by many to a period antedating the whites, seems quite modern, and has upon its surface distinct file marks which could apparently only be made with the white man's file.

One of the most pronounced types of aboriginal American pipes would by many be said to be the familiar Micmac pipe, found as far south as Ohio and Kentucky and from the Atlantic north of the Great Lakes to the Pacific Ocean. This pipe is commonly so profusely ornamented and so often has its bowl bored by means of a tubular metal drill and is so uniformly finished with a file as to leave little doubt of its being made with modern metal tools. These pipes with their keel-like bases bored with from one to six holes for the purposes of attaching tassels and strings to prevent loss in the snow, are usually of most symmetrical shape. This pipe is still made in Labrador, and specimens are known that are finished with totemic figures upon their bowls, carved with a skill and with characters that could scarcely be claimed to be Indian.

The disk pipe, usually found in the States of Illinois, Missouri, and Kentucky, with specimens from Ontario, are of mound type, though their outline is so similar to the jews'-harp as to raise suspicion that such an instrument furnished the model for the type. The jew's-harp was a common article of barter with the natives, and on many occasions is mentioned among presents given at some treaty made at a council meeting between the whites and Indians. Specimens of this type made of catlinite would also suggest a modern period for the origin of the type, for there is doubt whether catlinite was ever traded so far from the quarries until subsequent to the advent of the French.

The Iroquoian pipes found along the river St. Lawrence and in the neighborhood of the Great Lakes may be said to vary one from the other more than pipes found in the eastern United States. First they were curved clay pipes having bowl and stem in one; then pipes made of a stalagma, the straight stems of which are at right angles almost with the bowls, and finally stone pipes of the bowl type for separate stems of wood. All three of these pipes are found in the area of influence of the Iroquoian confederacy and with scarcely an excep-

tion presenting peculiarities of workmanship which render them readily distinguishable. These pipes with but slight doubt show that their period is subsequent to the arrival of the French. The curved clay pipes are usually of a hard burned pottery with fine tempering material, molded in artistic forms, and at times the pottery itself appears to be cut subsequent to burning. The shapes of these pipes suggest the hunting horn, the grenadier's hat, sacred pictures, etc. The grenadier type is retained in the pipes of stalagma. In the bowl type there appears to be a suggestion in several specimens of the jumping jack. In all three are peculiar depressions upon the surfaces of specimens suggesting the possibility of their being intended for inlaying. There are so many European characteristics in pipes of the Iroquoian type as to leave scarcely a doubt of their deriving their forms entirely from the French. The art concepts present both the serious and grotesque in a manner more suggestive of the French than of native American ideas.

The word "calumet," a synonym for the peace pipe, is said to be derived from the Norman word "chalumeau," a reed. The same word is corrupted as "chalmy," a musical instrument of the time of Queen Elizabeth. Calumet originally was employed to designate that pipe, of whatsoever type, used between the whites and the Indians in their negotiations of treaties and of commerce of every kind. The word calumet, at present, however, may be said to indicate that pipe which was probably the one given to the Jesuit Father Marquette in his first trip down the Mississippi, namely, the red Siouan catlinite pipe, the stone being a vermilion-colored indurated clay, quarried in the State of Minnesota. The Siouan pipe has a high bowl, always rising at right angles to the stem, and has a long projection or prow on the opposite side of the bowl from the stem. In the older specimens bowl and stem holes are approximately of the same size, about one-third of an inch in diameter. The earlier specimens are smoothed and unornamented, while the later ones are highly polished, and often inlaid with plates of lead, and at times even have duplicate bowls. This type was originally used by the French as a flag of truce, because accepted in Marquette's trip down the Mississippi by affiliated tribes, who by its decorations and type probably recognized it as coming from friends; but it appears even on that occasion to have been ignored by Indians visited on the lower part of the river.

The English were probably the first to use as a flag of truce the collar or belt of wampum, just as the French did the pipe. Later, because of the want of a written language, both pipe and wampum belt seem to have been commonly employed as a reminder of agreements entered into between the whites and natives, a species of temporary ideograph, which after having answered the full purpose of one treaty or contract could later be used for another. The decorations of pipe and belt appear to have been considered in sections or chapters, as it were,

between each of which presents were usually exchanged when a treaty was in progress of negotiation. This ideograph was used when treaties were made with the Indians, who were accompanied by a regular delegation, whose duty it seems to have been to see that the chapters or stations of the belt or pipe were properly repeated by its bearer and to interrupt his speech whenever not correctly repeated as agreed upon by the tribe. The individual pipe was often employed as a pledge, which when deposited must always be redeemed according to the strict letter of the agreement. The commonly accepted theory of the great sanctity of the pipe of peace as a protection to those accompanying it does not historically appear to have been well founded.

The calumet dance of the Indians seems to have been widespread through the continent, so far as may be judged by the meager references we have to it. It was a function of some religious or mystic character, extensive presents being given upon the occasion, the individual danced to or for being considered thereafter to be an adopted child of the dancer. The flag of the United States, after the cession of Louisiana, was used in place of the French pipe in the acquired territory. Such agreements were later evidenced further on the part of the United States by the presentation of medals bearing the head of the then President or "Great Father," as he was called by the Indians. The red color, designating war, and the white, peace, was possibly suggested by the colors respectively of French and English flags.

The typical, elaborate, and artistic curved-base mound pipes, found to be contemporaneous with copper implements, are drilled by means of tubular and solid drills, almost necessarily made of metal. In certain instances the shapes of bowl cavities are of an irregular form, indicative of the use of a loose drill head; which supposition, if correct, would suggest the use of either a pump or strap drill, probably the former, either of which implements appears to have been unknown to the natives prior to the advent of the whites. The polishing of this type of pipe is so perfect as to raise a suspicion of white influences. The common observance on pipes of this type of marks which seem to be those of the file suggests white man's tools in fashioning them. The fine lines cut on many of these pipes would indicate the possible use of steel tools; inlaid eyes suggest modern methods. Carving in the round as perfectly as is done in pipes of this type also implies modern influences and the presence of the white man, as do objects of copper covered with silver found in contact with these pipes. Besides this, the knowledge of the existence of the elephant and the finding in the mounds articles of undoubted European origin are all suggestive of the comparative modern date of pipes of the curved-base mound type. It does not of necessity follow that these pipes were of foreign manufacture, but probably they were the handiwork of fur traders and hunters catering to native trade demands. The figures on these pipes are doubtless of totemic significance, and, with few exceptions, face the

smoker; and where an exception is noted, it is commonly observed that the stems on the front end have been broken. The figures beyond, being of men, beasts, birds, and reptiles, are seldom of determinable species. The finding of pipes of this type made of catlinite is indicative of modern influences, though by no means proof of it. The area of distribution of this type conforms to the route of the early French voyageur and of the missionary.

The double conoidal pipes commonly found along the Lower Mississippi and in the southern United States generally have large bowls and stems bored at right angles one to the other, the openings of which are an inch or more in diameter. They are almost always of stone, and are bored by means of a solid drill, though pottery specimens are known. These pipes vary enormously in exterior shape, all the way from the unornamented cube to the most elaborate animal form. Upon the bases of pipes of this type, which invariably face from the smoker and are often made of a gritty sandstone, are commonly noticed deep grooves, apparently made for the purpose of sharpening some tool, though what, it is impossible to say. The frog is a form commonly encountered in pipes of this type, though animal figures are often found; where in imitation of men, they are usually in crouching positions.

A most elaborate type of pipe, which has been designated as the "idol pipe," and found in the mounds and stone graves of Georgia, Tennessee, and Arkansas, has some features suggesting a kinship with pipes from the Etowah Mound, Georgia; but while these pipes appear to belong to a distinct type, too few of them are known to justify any definite opinion concerning them.

During the colonial period there are often encountered references to "great pipes," which appear to have been pipes of large proportions compared with those of the usual type, and were the property of the tribe rather than of the clan or of the individual. Some few specimens of these pipes are known, which seem to have been made by the whites, of whose manufacture of pipes of this type one or more records are preserved. The Northwest Fur Company are said to have traded stone pipes with the Indians in exchange for furs; and John Smith, in Virginia, is known about 1608 to have asked permission of Powhatan to go through his territory to obtain stone for making axes, and the presumption forces itself upon one that the trade and manufacture of stone implements has been greater than is generally supposed.

The natives certainly of a part of the far Northwest appear to have seen the first white people during the present century and to have first learned from them the smoking habit. Pipes of the Northwest coast are for the most part comparatively modern and made for sale, and consequently their shapes are as varied as the materials from which they are manufactured. The natives of Queen Charlottes Islands carve with metal tools most elaborate pipes from a blue slate, with most artistic and typical figures, though the pipes of this material are so

diverse that little study has been given them, nor has reference been made particularly to the walrus-ivory etched pipes made for sale to the tourist and not for practical use.

The Eskimo pipe in type appears to have derived its form from the Japanese pipe and to have been introduced from Japan, from whose people the Eskimo seem to have adopted the smoking habit, or else this pipe may have been introduced from Kamchatka, whose people may have adopted smoking from the Japanese.

The modern Pueblo pipe is of a distinct type, resembling both in the character of its pottery and in the size of its stem opening the Iroquoian pipe.

The form called the Delaware pipe appears to be of totemic character, is carved with considerable skill, and impresses one as being of recent origin and made with modern metal tools.

Along a great part of the Atlantic coast a class of pipes is found usually made of chlorite and worked with exquisite skill. Their long stems, bored with holes often 8 or even more inches in length, indicate that those using them were rather of sedentary than of nomadic character. This perfection of boring would also suggest rather a metal than a more primitive drill. A pipe of this character is at times encountered in the shell heaps of the Middle Atlantic coast, upon which characteristic linear Indian etching is observed.

There are found in graves and mounds in the Carolinas, in Georgia, and in Tennessee pipes of somewhat like character made of a green chlorite with embossed disks upon their bowls, and tongues both in relief and in intaglio, that show as great conventionality as any pipes found in America, and which would indicate in color and design hammered-metal prototypes. Specimens presenting similar characteristics are found made of pottery. These last, again, grade into elaborate and highly conventionalized pottery man and bird forms, which present certain art characteristics observed in pipes found in part of the Iroquoian area of the North, though there is sufficient distinctness between the two to enable one to be distinguished from the other. A single molded pottery pipe found in or near the Etowah mound has the tobacco leaf artistically arranged on bowl and stem, and a modern Dutch pipe from Guda, Holland, has the same tobacco leaves, with the addition of a bird's beak, identical in concept with pipes from the Etowah mound, evidencing a relationship which appears traceable through the Huguenots who went to Holland, migrated to French Acadia, and who, after the acquisition of the territory by the English, refused to take the oath of allegiance and were in great numbers transported to the South.

Specimens of catlinite made in tubular shape do not appear to have been found, and where specimens of other types than the Siouan, in whose territory the quarry is located, are found made of catlinite, it tends to raise the question whether they are not comparatively mod-

ern. While the indurated clays and metamorphic stones generally work well by pecking with the stone hammer or point, catlinite, which there are indications was in the primitive period worked by pecking, is at the present time worked by sawing, which is readily done with metal and sand. The drilling of this stone is comparatively simple with a stick and dry sand, which, however, if wet, would pack in the perforation besides swelling the wood point if one were used. Drilling in curves like the supposed evidences of hardening of copper by the ancients is a myth, and no evidence is known of its ever having been done by primitive people through any mass of uniform hardness.

While, as a matter of course, it is possible to make pipes and pass them off as genuine and thus to deceive even experts, it is believed that such a thing could not be successfully accomplished except in rare instances, and the writer has been surprised that in the mass of pipes that have been examined by him so few show any evidence of being frauds. On the other hand, the evidences of the use of the white man's tools as well as art ideas are on so many types of pipes as to convey the distinct impression of early colonial legitimate trade in stone objects. That totemic figures better enhance values is self-evident. Is it to be assumed, then, that the voyageur, trapper, or hunter would not with his knife or file make pipes to supply such demand. It must also be remembered that carving during the early colonial period was a much more prevalent accomplishment than at present.

It has been observed that quite a number of pipes have been referred to upon which dates are scratched or cut, and while such specimens will always be scrutinized with suspicion, the dates in the majority of instances, it is contended, should be accepted as accurate, not necessarily of the period of their manufacture, but rather of their first possession by the wihte man.

As the data upon which the foregoing conclusions are based are embodied almost completely in the foregoing pages, students of the subject will, it is hoped, be enabled to judge of their correctness.

ADDITIONAL NOTES.

During the preparation of this paper some notes were mislaid, others were laid aside and not found until the paper was in the printer's hands, and still others have come more recently to the writer's notice, making together quite a number of references, some of which throw additional light on the question under discussion, and it has consequently been considered desirable to embody them as succinctly as possible in a brief series of additional notes.

McCulloh, in the account of his captivity by the Indians, in Loudon's exceedingly rare work, refers to a peculiar method of burial employed by the natives about 1756, which would appear very similar to the burial method of the people of the stone graves in Kentucky and Tennessee. He says: "They dig the grave about 4 or 5 feet deep,

directly east and west; they make slabs which they place in the bottom and at each side, then lay the corpse with the head to the east and put a broad slab over the top; then fill the grave nearly full of stones, heaping the earth which they dug out of it on the top."[1]

The Indians encountered by the French were probably all nomads or wanderers, seldom remaining more than a few weeks in one place. It was said in Le Jeune's Relation, as late as 1634, "that we shall work a great deal and advance very little if we don't make these barbarians stationary. As for persuading them to till the soil of their own accord without being helped, I very much doubt whether we shall be able to attain this for a very long time, for they know nothing whatever about it."[2]

A reference of 1636 in Le Jeune's Relation to the head covering is of some interest as possibly throwing light on the period of certain pipes representing natives' hats or hoods, as follows: "These people go bareheaded except in the most severe cold, and even then some of them go uncovered, which makes me think that very few of them used hats before their intercourse with our Europeans. Nor do they know how to make them, buying them already made, or at least cut, from our French people."[3]

Mr. David Boyle, of Toronto, has referred to a brass tomahawk pipe in the George E. Laidlaw collection, on deposit in the Ontario Archæological Museum, which is "elaborately chased and otherwise decorated." The bit is of steel neatly dovetailed into the brass, but not soldered.[4]

The illustration of this specimen is of the type of fig. 85, the chasing being of the character of that on the specimen in the museum of the University of Pennsylvania from California, and its symmetry is as perfect as any of the pipe axes of the English. It was found near Balsam Lake.

McCulloh refers to an Indian of western Pennsylvania about 1756, named Ket-tooh'ha-lend, who "sunk his pipe-tomahawk" into the head of another.[5] This would probably be the metal tomahawk, which would make it somewhat an older instrument than the writer had heretofore found references to support.

Mr. Boyle has recently described a number of pipes, both of pottery and of stone, that are now in the Ontario Archæological Museum, belonging to the Iroquoian type. Some of the pottery specimens

[1] Archibald Loudon, A Selection of the Most Interesting Narratives of Outrages Committed by the Indians in their Wars with the White People, I, p. 350, Carlisle, 1808.

[2] Le Jeune's Relation, Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaite, VI, p. 149.

[3] Idem, VII, p. 11.

[4] Tenth Annual Report of the Ontario Archæological Museum, 1897–1898, p. 31, fig. 40, Toronto, 1898.

[5] Archibald Loudon, Narratives of Outrages, etc., I, p. 329.

illustrated have double faces on their bowls, one facing toward and and the other facing from the smoker, from Bexley Township, Ontario.[1] Other of these illustrations would indicate masks. Mr. Boyle in his publications demonstrates the great diversity of exterior form of the Ontario pipe. The bowls and stem openings of the pottery specimens remain of type character, though a single one appears to have been enlarged for the reception of an artificial stem.

Parkman's says that the Jesuits were reported to have carried on trade through the savages for furs,[2] this primitive intercourse of a commercial character would have been a most effective method for opening the road to the missionaries through the territory of the savages, which once opened would afford opportunity for the spread of the doctrines of the church.

The term "tabagie" or "tabagio," at times occurring in early French publications, is evidently derived from the word "tobacco" and has its origin in the smoking habit. Marc Lescarbot, in referring to a victory of the French and their Algonquin allies on July 29, 1609, over their Iroquoian enemies, speaks of it as a triumph which they celebrated with great festivities, consisting of continual tabagie, dances and chants, according to their custom.[3]

A reference by Biard about 1632, that "the savage made tabagie for them all with moose meat,"[4] would indicate that the term at this period had come to signify a feast, as it appears later to have become corrupted into "tapage", a row or noise.

Father Pierre Biard, referring to demands of the Indians for tobacco in 1611, says the king should present him 4 or 5 pounds of bread, 3 of peas or beans, 1 of tobacco, 4 or 5 cloaks worth 100 sous each, bows, arrows, harpoons, and other similar articles.[5]

As akin to customs existing in other parts of the country, reference is made in 1616, in Acadia, to the fact that, if the dying man has some supplies on hand, he must make tabagie of them for all his relations and friends.[6]

Biard, in 1616, further says: "They also use tobacco and inhale the smoke, as is done in France. This is without doubt a help to them, and upon the whole rather necessary, considering the extremes of cold and bad weather, and of hunger and of overeating and satiety which

[1] Tenth Annual Report of the Ontario Archæological Museum, 1897–1898, p. 17, fig. 7, Toronto, 1898.

[2] Francis Parkman's Works, p. 38, Boston, 1895.

[3] Marc Lescarbot, The Conversion of the Savages, Jesuit Relations and Allied Documents, I, p. 107, Cleveland, 1896.

[4] Father Pierre Biard, Relation de la Nouvelle France, Jesuit Relations and Allied Documents, V, p. 27.

[5] Letter to the General of the Society of Jesus, Jesuit Relations and Allied Documents, I, p. 177, Cleveland, 1896.

[6] Father Pierre Biard, Relation de la Nouvelle France, Jesuit Relations and Allied Documents, III, p. 127, Cleveland, 1896.

they endure. But many ills also arise from it on account of its excessive use. It is the sole delight of these people when they have some of it, and certain Frenchmen are also so bewitched with it that to inhale its fumes they would sell their shirts. All their talks, treaties, welcomes, and endearments are made under the fumes of tobacco. They gather around the fire, chatting and passing the pipe from hand to hand, enjoying themselves in this way for several hours, such is their inclination and custom."[1]

The area of French influence was continually widening as those wanderers, the coureurs du bois, went farther and farther into the wilderness in search of skins, until La Salle, in 1670, appears to have arrived at the falls of the Ohio, where he was deserted by his people and was forced to return.

Tobacco, according to Peter Heylyn, about 1682, was called the "Henbane of Peru," quoting "Gerard and some other of our modern herbalists," but he says, "Tobacco is by few now taken as a medicine, and it is of late times grown a good fellow, and fallen from a physician to a complaint. The taking of tobacco was first brought into England by the mariners of Sir Francis Drake in 1585, and it happened not unfittingly in the way of an antidote to that immoderate use of drinking which our low country soldiers had brought out of the Netherlands much about that time."[2]

If we can believe Jouvency, the moose would appear to have taken the place of tobacco as a universal medicine and remedy, for he says of it, about 1710, "The savages eat its flesh, are clothed with its skin, and are cured by the hoof of its left hind leg." He also says, "It avails against epilepsy, nor does it have less power with the cure of pleurisy and six hundred other diseases."[3]

As a suggestion probably throwing some light on the shape of those pipes resembling the human arm, that of Le Jeune referring to the Indians of Canada is of interest. He says: "Nearly all the savages have a little castipitagan, or tobacco pouch, made of the skin of the muskrat. Some of them carry a part of an arm or a hand of a hiroquois whom they have slain, which is so skillfully prepared that the nails remain entire. You would really think it was a solid hand when they fill it with tobacco or something else. I have not seen any of these, but am assured that it is so."[4]

According to Baron de Bonstetten, "In China, in India, in Persia they have smoked from time immemorial the grain of hemp, like the Scythians of Herodotus. In Ceylon, Java, Siam, Japan, Cochin China,

[1] Father Pierre Biard, Relation de la Nouvelle France, Jesuit Relations and Allied Documents, III, p. 117, Cleveland, 1896.

[2] Cosmography, Chiography, and History of the Whole World, p. 125, London, 1682.

[3] Joseph Jouvency, Country and Manners of the Canadians, Jesuit Relations and Allied Documents, I, p. 249.

[4] Le Jeune's Relation, Jesuit Relations and Allied Documents, V, p. 131, edited by Reuben Gold Thwaite.

and China it is opium which is especially in favor and proves the antiquity of the habit.

The Portuguese, Odoardo Barbosa, in the account of his voyages, 1519, says that at that time the Chinese bought opium in India.

Nanah, the prophet of the Sikhs, born in 1419, defends in his decrees the use of the pipe among the Sikhs, but found the practice so noted among the Hindoos that he made an exception in their favor.

In the beginning of the seventeenth century a series of edicts were published in Turkey against smokers, and in Constantinople everyone found by the police smoking a pipe in the streets was handed over to the executioner.

Marco Paulo makes no reference in the middle of the thirteenth century to the pipe and to the smoking habit."[1]

Bonstetten also says:

"The Buriats; inhabitants of the banks of the Baikal, mix the bark of pine with tobacco.

"The Karaks of Tasseeva offer pinches of tobacco to the rivers and mountains; like them the Ostiaks bury a pipe with the dead."[2]

Navarette, referring to Columbus's messengers who were sent ashore, says: "The two Christians found on their journey many people returning to their villages, and both men and women carried in their hands a lighted coal and herbs for perfuming themselves, as is their habit."[3]

Yet it will be remembered that another author has referred to this same occurrence in a somewhat different manner.

Columbus describes the religious ceremony of placing a platter containing cohabba on the head of the idol, the worshippers then snuffing up the powder through a cane with two branches.[4]

E. R. Billings says Oviedo describes the bifurcated implement "as about a span long."[5] This implement as a snuffing tube has been fully discussed by Dr. Max Uhle in his paper, referred to earlier in this work, in which he shows that somewhat similar implements have been employed in various parts of Central and South America.

A tube, though employed for an entirely different purpose, is described by Eivind Astrup as in use by the natives of Cape York. He says: "At the side of the lump of meat stood also a huge block of ice as clear as crystal, whence the community obtained water, as in the center of it a cavity had been cut, at the bottom of which a stone was placed of the size of a man's fist, on which there burned with a good flame a piece of moss intersected with blubber; and as the ice melted at the sides of the cavity, the water collected at the bottom in

[1] Baron de Bonstetten, Recueil d'Antiquitées Suisses, Pt. 3, p. 14, Berne and Paris, 1855.

[2] Idem, p. 14.

[3] M. F. De Navarette, Relation des Quatres Voyages de Christophe Colomb, II, p. 167, Paris, 1828.

[4] Condamine's Travels in Pinkerton's Voyages and Travels, XIV, p. 226.

[5] Tobacco, its History, etc., p. 33, Hartford, 1875.

a small clear pool, whence it was consumed by the many parched mouths by sucking it up through hollow reindeer marrowbones, in exactly the same manner in which we enjoy a sherry cobbler through a straw."[1]

Dr. Barber says: "The Pah Utes, according to Mr. Edward Palmer, use the leaves of *Arctostaphylos tomentosa*, the Manzanita of the Spanish, for tobacco and also as a medicine."

Mr. A. E. Douglass has in his collection a very remarkable brown stone pipe, belonging to the biconical type in the form of a human head. It was found it is said about 100 feet from a small rock mound near Coolville, Athens County, Ohio. The mouth, apparently the bowl, shows that it has been bored out by means of a tubular drill as there is a protuberance at the bottom. The ears are carved to give the impression of having in them the familiar copper discoidal spools at times found in Ohio. The specimen presents every appearance of genuineness and some of its features are unique. It has been badly battered by children who have played with it.

Prince Maximilian, of Wied, refers to some of the Indians of Indiana who smoked sumac leaves in wooden pipes. "The Cherokees also of the Southern States used wooden pipes carved in the form of bears, the bowl being in the back and the tube orifice near the tail."[2]

The pipe here described might be the biconoidal pipes referred to, or possibly it might refer to a pipe illustrated by Schoolcraft and now in the museum of the University of Pennsylvania. This pipe is cut through a block of chlorite, which exteriorly is of a rude animal shape, the legs being represented in low relief, as seen in fig. 157. The eye is cut into the stone. The stem opening of this pipe and the bowl, which were from Camden, South Carolina, are almost in the same plane and would entitle it to be classed rather with the tubular pipes than with another form. The surface of this pipe is black and glossy, and it would appear entitled to be classed among unique specimens, the form being apparently given by means of the hammer stone by pecking.

Holm quotes P. Lindstrom, about 1650, who he says writes as follows: "Their money is of shells, white, black, and red, and worked into beads and neatly turned and smoothed. One person, however, can not make more in a day than the value of six or eight stivers. When those beads are worn out so that they can not be strung neatly and evenly on the thread, they no longer consider them as good. Their way of trying them is to rub the whole thread full on their noses, and if they find it slides smooth and even, like glass beads, then they are considered good. Otherwise, they break and throw them away. Their manner of measuring the length of their strings is by their

[1] Eivind Astrup, In the Land of the northernmost Eskimo, from Fortnightly Review, Littell's Living Age, No. 2701, p. 112.

[2] Travels in the Interior of North America, London, 1843, translated from German by Lloyd.

thumbs. From the end of the nail to the first joint makes six beads, of which the white ones are worth a stiver or piece of copper money, but the black or blue ones are worth two stivers or a piece of silver."[1] He says these beads are cut of brown or white cockle, muscle, or oyster shells.[2]

According to Georg Heinrich Loskiel the belts of wampum were regulated in size according to the importance of the subject intended to be discussed on the part of whites or Indians, and before they used the string or belt of wampum the wing of a large bird was used in its place. The belts and strings, he says, are employed to speak from and to remind one of business transactions. This is still used, he says, by those living west.[3]

The Swedes settled on the banks of the Delaware under Capt. David Pietersen De Vries in 1631, where he arrived with two ships. "He returned again in 1632 and found the fields of his new colony strewed with the bones of his countrymen. The arms of Holland, emblazoned upon a piece of glittering tin, had been elevated upon a pillar. An Indian stole it to make a tobacco box. The commandant took offense: they quarreled; and the colonists were all butchered while at work in the field."[4]

A broken specimen of a pipe of the heavy animal and bird type (fig. 65), which is 1½ inches high and made of steatite, collected by Dr. J. H. Elder about 3 miles from Watkinsville, Georgia, the bowl of which is 2½ inches above the back of a bird, is an interesting specimen of the type, in that incised lines are cut into the stone to represent conventional wings of some bird, as we may distinguish by later specimens in which the wings are represented by being carved in a low relief. The head of the bird is represented also by incisions and, were it not for the conventionalized wings, might as well be taken for that of a turtle. Upon the side of the bowl a word or name, apparently Canonic or Ganonic, is incised, and under it the date 1541. The lines of the name appear as old as the incised lines, though the date is evidently recent. This pipe is apparently an old specimen of the type.

A finely ground specimen of serpentine, belonging to the type of which fig. 108 is an example, collected by Mrs. Reeves of Sun Prairie, Wisconsin, has been called to the writer's attention by Prof. W. H. Holmes. The prong at the base has the unusual length of 4 inches from the point to the bottom of the bowl. The stem and bowl appear similar to the illustration, the hole of the stem being about one-eighth of an inch in diameter. There is scarcely sufficient bowl remaining to determine more than that its cavity has been made by means of a

[1] Thomas Campanius Holm, A Short Description of the Province of New Sweden, now called by the English Pennsylvania, p. 132, translation, Philadelphia, 1834.

[2] Idem, p. 133.

[3] Geschichte der Evangelischen Brüder in Nordamerika, Barby, 1789.

[4] Sherman Day, Historical Collections of the State of Pennsylvania, p. 9.

solid drill point. Pipes of this character appear to belong to a distinct type when it is considered over how extensive a territory specimens have been found, reaching from Tennessee to Wisconsin. The type has every indication of being modern.

A photograph in the U. S. National Museum of a bird pipe of the type of fig. 121, collected by Maj. W. B. Camp, from Sacketts Harbor, New York, has a hole bored from side to side of the knob representing the feet. The pipe is smoothly ground and apparently made of indurated clay.

The natives of western Pennsylvania about 1760 are said according to Loudon to have made "burnt offerings to their deceased relatives, such as tobacco, bread," etc.[1]

As did the natives of Virginia at the advent of the whites, and in this exceedingly rare work, it is related that Tecaughretanego, after building himself a sweat house and purifying himself therein, came out and began to pray and cast the last of his cherished tobacco into the fire; he then is said to have handed his white companion his pipe to smoke, though at that time he had nothing to smoke but red willow bark.[2]

The mixture of other plants with tobacco is here also noted and the friendly smoking referred to. "They are," it is said, "very fond of tobacco and the men almost all smoke it mixed with sumac leaves or red willow bark pulverized," and these Indians are said seldom to use it any other way.[3]

The conjurer's or medicine man's practices appear identical with those in other parts of the continent, as related in McCulloh's Narrative, contained in this work, in which the scene is described of a woman who places her hands one over the other upon a boil and sucking the hand and pretending to hand something from the mouth to the medicine man, who stepped out of the hut. A few days later he returns and smokes "qush-a-tik ok kil-lick ken-eek can;" that is, tobacco and mixture such as sumac leaves, red sally bark."[4]

Kalm refers to the wampum about 1749. He says: "Many people at Albany make the wampum of the Indians, which is their ornament and their money, by grinding some kind of shells and muscles. This is a considerable profit to the inhabitants."[5]

Soon after the landing of the Pilgrims at Plymouth, in December, 1620, namely, March 16, 1621, "Samoset came boldly among them and spoke to them in broken English, which yet they could understand, at which they marveled, but at length they understood that he belonged to the eastern parts of the country, and had acquaintance with sundry

[1] Archibald Loudon, A Selection of the Most Interesting Narratives of Outrages Committed by the Indians in their Wars with the White People, I, p. 341, Carlisle, 1808.

[2] Idem, I, p. 237.

[3] Idem, I, p. 276.

[4] Idem, I, p. 354.

[5] Peter Kalm, Travels into North America, II, p. 261, London, 1771.

of the English fishermen, and could name certain of them from whom he learned his language."[1] This occurrence is only an additional instance of almost every account of the traveler's first contact with the natives—that some one else of the same color or nationality was there, or had been there before them.

It is noteworthy that all references to the personal property of our American Indians indicate that it was inconsiderable. Peter Heylyn, about 1682, referring to the natives of Virginia, especially that portion known as "Novem Belgium or Nieu Nederlandt," says: "Their household stuff, a tobacco pipe, a wooden dish, and an hatchet made of a broad flint; their weapons, bows and arrows, their arrows headed with the bones of fishes."[2]

According to Everard, Clusius says, referring to Windaconoa, in 1585, with whose natives numbers of the Raleigh expedition came in contact, "The English returning from thence brought the like pipes with them to drink the smoak of tobacco."[3]

The native American arts and handiwork are beginning to be somewhat studied, and as a consequence a better understanding is had of limits to implements of native manufacture than was possible a decade since. Among other writers on the subject Dr. Brinton has claimed to find evidences of left-handedness in North American aboriginal art, having noticed an appreciable percentage among arrowheads.[4] If these views are correct, they differ from the experience of one authority herein quoted, who passed a considerable time among American savages living under primitive conditions, nor does it appear to the writer that the mere scrutiny of an arrow would be reliable as to how it would be held in process of manufacture, especially as blades in process of chipping are of necessity constantly reversed as the formation of the blade progresses.

The Choctaws, according to Dr. E. A. Barber, as well as the Mexicans, mixed their tobacco with the leaves of liquid amber.

As showing the wide areas over which specimens of catlinite have been found, Mr. Charles C. Jones, in a letter to Dr. Barber, refers to a pipe of this material found in an ancient relic bed about 25 miles from Augusta, on the Savannah River, in Georgia.

There is in the Douglass collection, in New York City, a pottery pipe from Franklin, North Carolina, which resembles a snake holding a vase in its distended jaws. This pipe is of interest as related to the bird pipes of Georgia (fig. 231), and possibly to those of northern New York (fig. 115) as well.

The Florida Indians during the first half of the sixteenth century, according to Cabeça de Vaca, built their cabins of mats on oyster-shell piles, on which they slept perfectly naked. They never, he says, build

[1] Nathaniel Morton, New England's Memorial, p. 30, Boston, 1855.

[2] Cosmography, Chirography, and History of the Whole World, IV, p. 96, London, 1682.

[3] Dr. Everard, Panacea, or the Universal Medicine, p. 63, London, 1659.

[4] D. G. Brinton, American Anthropologist, X, p. 179.

a cabin unless near wood and water.[1] De Vaca's narrative can not fail to be of interest, as being probably the first of a white man's experience within the confines of the territory north of Mexico.

Jean Ribault, in February, 1562, commanded for Coligny, who had secured a patent from Charles IX to colonize French Protestants in America, an expedition which sailed from Havre, France. At the end of April they reached the coast, and on May 1 discovered the river of May, now the St. Johns. Returning to their ships they sailed up the coast to Port Royal and located a fort not far off. They left there a small garrison and then returned to Europe. Two years later Laudonniere reached the coast, and in 1565 there was not far from one thousand persons in the third expedition of Ribault, who were all massacred by the Spanish.[2]

The Pehuenches of Parana smoke by passing one pipe around. Each one fills himself until he can inhale no longer, holds his breath as long as he can, and exhales through the nose. The Eskimo and the Japanese retain the smoke of a single whiff until they can endure it no longer.[3]

The natives of Patagonia are said to make wood or stone pipe bowls fitted with a silver or metal tube.[4] "The smoker," he says, "lights his pipe, then lies prone on the ground, and after puffing a portion of smoke to each cardinal point and muttering a prayer he swallows several mouthfuls of tobacco smoke, which produces intoxication and partial insensibility, lasting perhaps for the space of two minutes. The tobacco used for smoking (for they never chew) is generally obtained from the settlements, but failing in this a herb substitute is procured from the Araucanians. This is never smoked pure, being invariably mixed with either wood chopped up small or 'Yerba' [Paraguay tea] stalks if obtainable. The mixture with dung mentioned by M. Guinnard is unknown among the Tuelches."[5]

Certain of the natives of Terra del Fuego in 1822 were said to strike fire with iron pyrites against quartz.[6]

An early reference to incensing refers to Magellan's voyage where it is said, "Not far from Zubut lies the isle of Mathan. When a man of figure dies all the chief women go to his house, the room being incensed with myrrh and storax all the while."[7]

Mr. M. Eels, in a letter to Dr. E. A. Barber in 1878, says that among the Twanas, a part of whom talk the Skwaksin dialect of the Nisqually

[1] Voyages de Cabeça de Vaca, pp. 11, 117, translated from Valadolid edition of 1555.

[2] Charles W. Baird, History of the Huguenot Emigration to America, I, New York, no date.

[3] Hutchinson, Parana, p. 31, London, 1886.

[4] George Charworth Musters, At Home with the Patagonians, p. 169, London, 1871.

[5] Idem, p. 174.

[6] A. Morlot, General Views on Archæology, Smithsonian Report, 1860, p. 286, referring to Weddell's "A Voyage towards the South Pole in 1822 and 1824," London, 1827.

[7] John Harris, Voyages and Travels, I, p. 16, London, 1705, referring to the voyage of Ferdinandus Majelianes in 1521.

language, and the Clallams, at present, smoking is common, but he could not learn that there was ever any smoking previous to the coming of the English and Americans sixty or eighty years ago. When the Hudson's Bay Company came, it became more common.[1]

The Haidasta, Dr. Barber says, use the bark of *Cornus stolonifera*, also *Cornus sericea*, dried and prepared for smoking.

The Tunguses are said never to "travel without having a sort of censor hung on their arm (or little chafing dish). In throwing on this portable fire wood and half-dried herbs they stir up a great deal of odor to their fire which all the insects dislike."[2] The same author says the Lapps make this odor with sponge.

Mr. Raphael Pumpelly writes Dr. Barber from Oswego, New York, in 1878, that "in Ladak and Thibet the natives in traveling make a small, smooth hole in the ground, which they fill with tobacco, and then make a connecting hole through which they draw the smoke directly into the mouth, thus making the ground perform the parts of a bowl."

Mr. Clarence B. Moore has illustrated from mounds on the Georgia coast two or three other pipes, both of pottery and of stone, which present unique features impossible to classify with any type.[3]

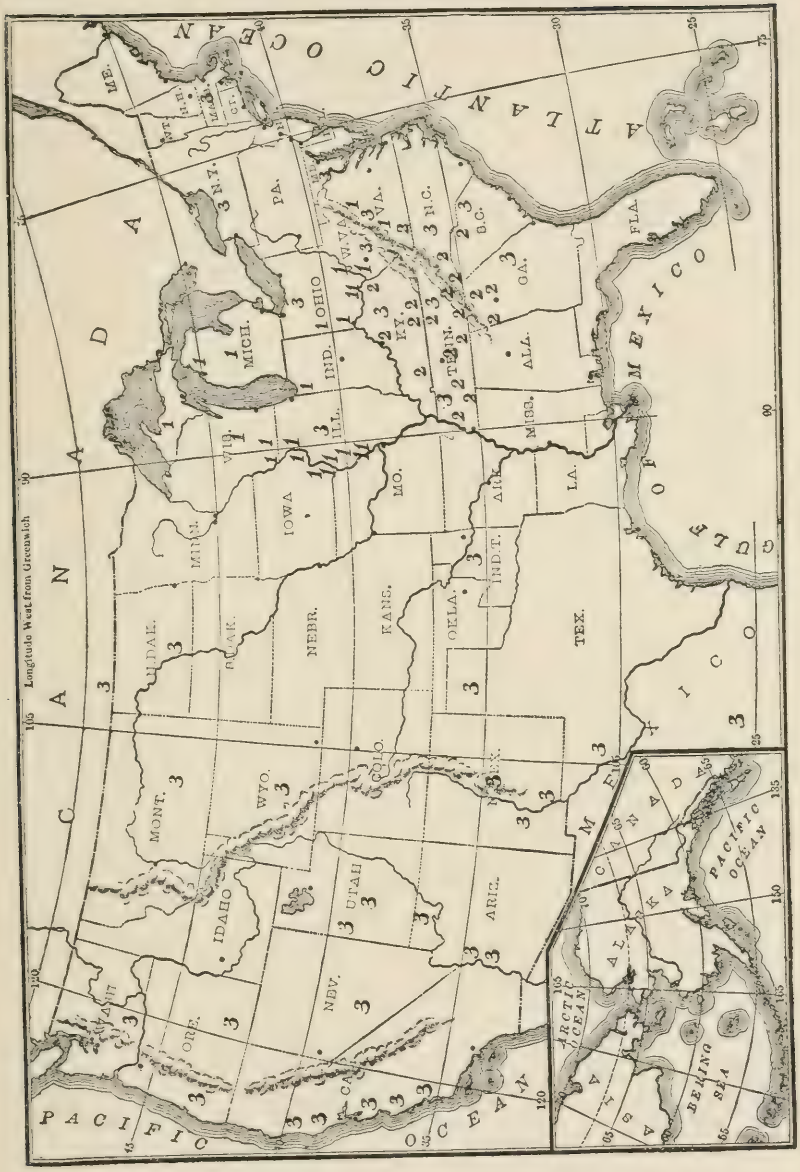
There are in the U. S. National Museum a number of walrus-ivory pipes which are commonly bored lengthwise of the tusk, one-half from each end. The opening in the larger end is subsequently plugged with a piece of ivory and colored black to conceal where the plug is inserted. At times the smaller end is shaped to form a mouthpiece; at other times an opening is left for the insertion of a mouthpiece composed of wood, bone, ivory, or even of metal, instances occurring of copper cartridges being so employed. The bowls of the character of those of figs. 188 to 192, inclusive, which appear to be of Japanese type, are held in position by gluing, mortising, with dowels, or, as is often the case, bound on with green seal skin thongs and allowed to dry. The bowls are variously of stone, bone, ivory, or metal. The etching on these pipes is often quite elaborate, representing scenes from Arctic daily life, both ludicrous and serious. There is a specimen of this type which has been bored by a succession of holes along the back all being subsequently cut into a single opening, which was subsequently closed with a tight plate as in fig. 189, though much longer. There is, however, strong reason to suppose such pipes to be modern and intended rather for sale than for smoking.

There is in the U. S. National Museum (No. 1210, loans catalogue) the cast of a steatite pipe in the form of a flying squirrel, collected by Maj. W. B. Camp, Sacket Harbor, New York, which is of unique character in that it is a straight tube, the exterior representing the squirrel with its extended wings in the act of sailing through the air. This pipe is described in the Proceedings of the Jefferson County Historical Society for 1895.

[1] Mr. Eels to Dr. E. A. Barber, September, 1878.

[2] Cornelius De Paw, Recherches Philosophiques sur les Américains, I, p. 247.

[3] Clarence B. Moore, Certain Aboriginal Mounds of the Georgia Coast, Philadelphia, 1897.

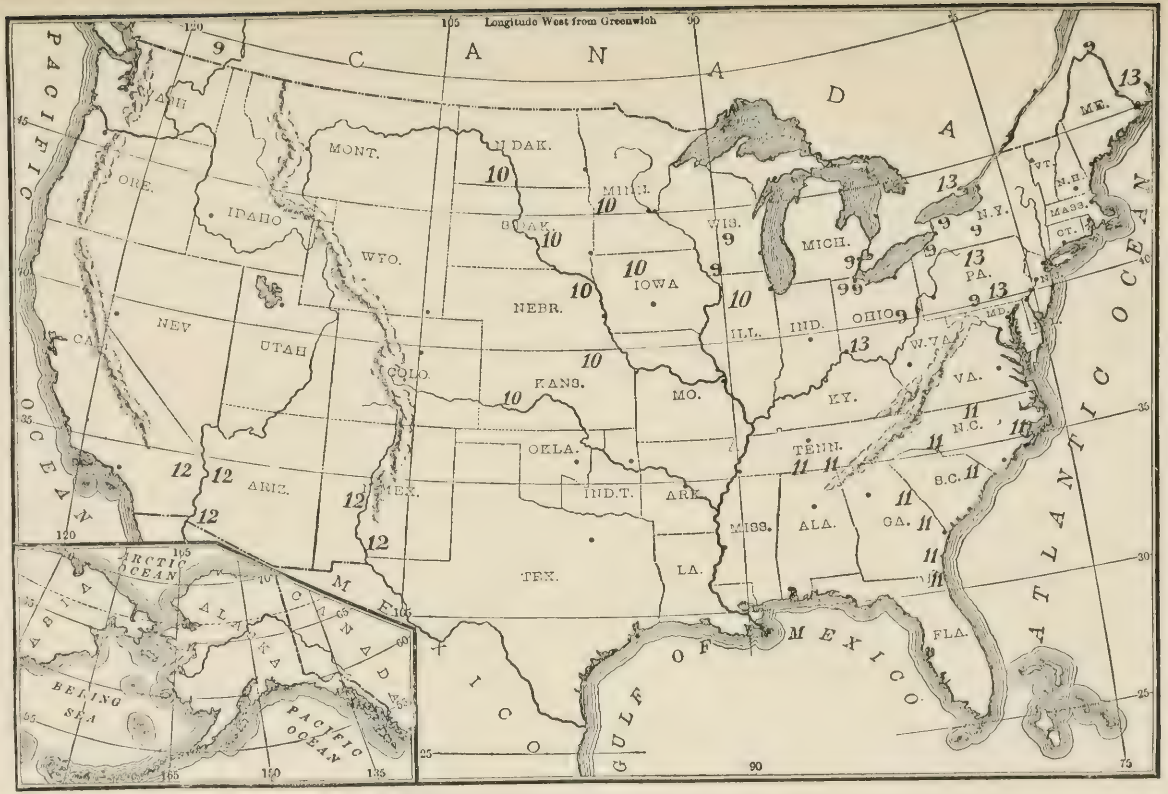


LOCALITIES WHERE TYPICAL PIPES ARE FOUND.

1. Curved-base mound pipe. 2. Heavy bird or animal pipe. 3. Tubular pipe.

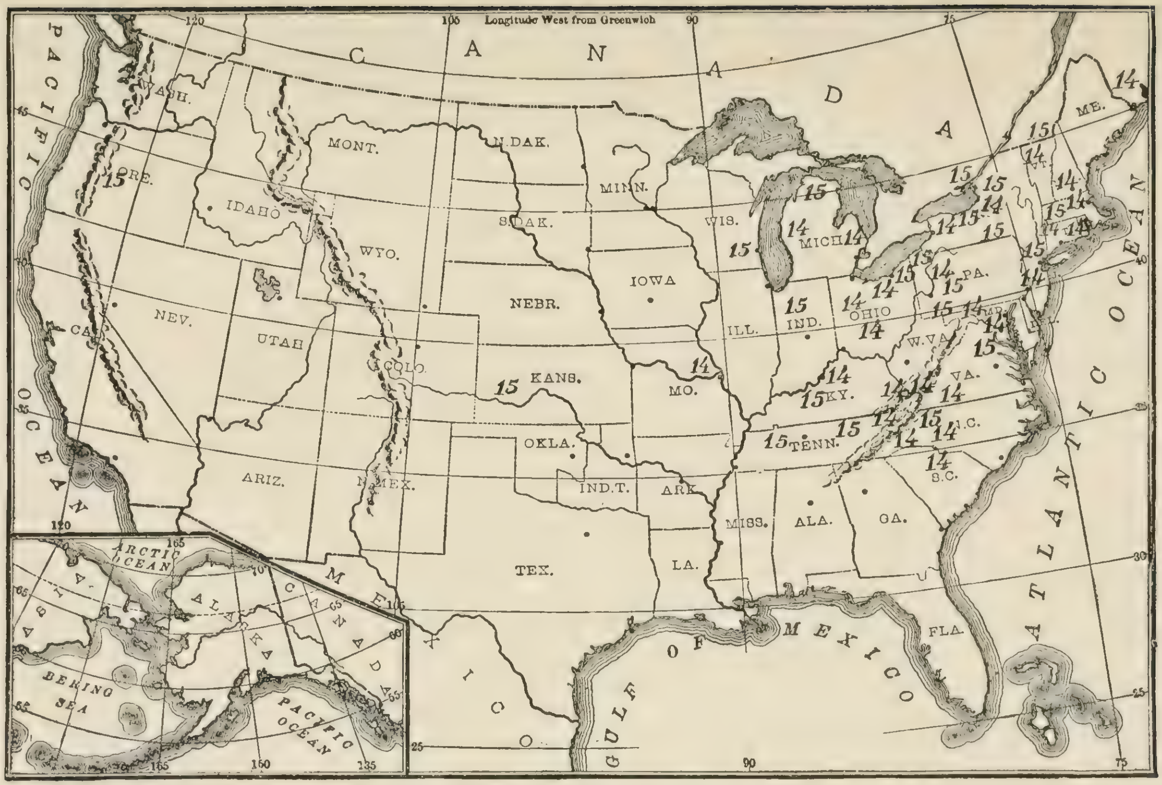
LOCALITIES WHERE TYPICAL PIPES ARE FOUND.

4. Iroquoian clay pipe.
5. Iroquoian grotesque bird pipe.
6. Iroquoian rectangular pipe.
7. Disk or jewsharp pipe.
8. Biconical pipe.



LOCALITIES WHERE TYPICAL PIPES ARE FOUND.

9. Micmac, keel-base pipes.
10. Siouan and Catlinite type.
11. Southern mound type.
12. Pueblo pipes.
13. Rectangular pipes, birds and animals on bowls.



LOCALITIES WHERE TYPICAL PIPES ARE FOUND.

14. Monitor pipe.

15. Bowl and vase-shaped pipes.

CATALOGUE OF THE SERIES ILLUSTRATING THE PROPERTIES OF MINERALS.

BY

WIRT TASSIN,

Assistant Curator, Division of Mineralogy.

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Assistant Curator, Division of Mineralogy.

INTRODUCTION.

The wall cases on the west side of the Mineral Hall contain a series of specimens, models, and labels illustrating and defining the several characters or properties of minerals. Accepting the definition of a mineral to be a definite chemical compound occurring in nature, which is usually capable of assuming a crystalline form when in the solid state, the subject-matter, consisting entirely of the labels used throughout the series, may from this definition be made to fall under two heads:

I. Chemical mineralogy, which treats of those properties relating to chemical composition or atomic structure of a mineral, and the chemical relations of the several kinds of minerals.

II. Physical mineralogy, which treats of those properties relating to form or molecular structure of a mineral, and the action of the various physical forces upon the several kinds of minerals.

SYNOPSIS OF ARRANGEMENT.

I. CHEMICAL MINERALOGY.

The elements: combination; types of minerals; variations in composition; relation of water to composition; relation of water to physical properties; relation of composition to physical properties.

II. PHYSICAL MINERALOGY.

A. Properties relating to form or molecular structure: The crystal: crystallographic axes; crystal form; crystal systems—isometric, tetragonal, hexagonal, orthorhombic, monoclinic, and triclinic; symmetry and the thirty-two types: compound crystals; imperfections of crystals: pleomorphism, isomorphism; pseudomorphs; crystalline aggregates.

B. Characters relating to cohesion and elasticity: Cleavage; gliding, pressure, and separation planes: fracture; hardness; tenacity.

C. Characters depending upon mass or volume: Specific gravity.

D. Characters relating to heat, magnetism, and electricity: Heat, magnetism, electricity.

E. Characters depending upon the action of light: Light; transmission of light—diaphaneity; absorption of light—color, essential color, nonessential color, and varieties of color; emission of light—phosphorescence; reflection of light—luster; refraction of light, uniaxial and biaxial crystals; diffraction of light; polarization of light, by reflection and simple refraction, double refraction, and absorption; interference figures, isotropic class, anisotropic class; dispersion of the optic axes, orthorhombic, monoclinic, and triclinic.

F. Characters depending upon the action of the senses: Touch, taste, and odor.

G. Characters depending upon the resistance to chemical action: Corrosion figures; solution planes.

The visitor is advised to study the series in the order indicated by the case lettering, regarding each panel as a unit, and reading from left to right, beginning with the upper left-hand corner as in a book.

I. CHEMICAL MINERALOGY.

THE ELEMENTS.

The chemist has made known the existence of a number of kinds of matter which can not be resolved into more simple forms. These kinds of matter, of which there are about seventy at present known, are by agreement called elements. The elements unite with and often replace one another in certain constant proportions by weight. These weights are expressed by numbers variously designated as equivalent, proportional, reacting, and combining weights and as atomic weights. The elements with their symbols and atomic weights are:

Table of Atomic Weights.

Name.	Symbol.	Atomic weight.	Name.	Symbol.	Atomic weight.
Aluminum	Al	27.11	Erbium	Er	166.3
Antimony	Sb	120.43	Fluorine	F	19.03
Argon	A	(?)	Gallium	Ga	69.0
Arsenic	As	75.09	Germanium	Ge	72.3
Barium	Ba	137.43	Glucinum	Gl	9.08
Bismuth	Bi	208.11	Gold	Au	197.24
Boron	B	10.95	Helium	He	(?)
Bromine	Br	79.95	Hydrogen	H	1.08
Cadmium	Cd	111.93	Indium	In	113.7
Calcium	Ca	40.08	Iodine	I	126.85
Carbon	C	12.01	Iridium	Ir	193.12
Cerium	Ce	140.2	Iron	Fe	56.02
Cesium	Cs	132.89	Lanthanum	La	138.06
Chlorine	Cl	35.45	Lead	Pb	206.92
Chromium	Cr	52.14	Lithium	Li	7.03
Cobalt	Co	58.93	Magnesium	Mg	24.29
Columbium	Cb	94.0	Manganese	Mn	54.99
Copper	Cu	63.60	Mercury	Hg	200.
"Didymium"	Di	142.00	Molybdenum	Mo	95.98

Table of Atomic Weights—Continued.

Name.	Symbol.	Atomic weight.	Name.	Symbol.	Atomic weight.
Neodymium	Nd	140.5	Sodium	Na	23.05
Nickel	Ni	58.69	Strontium	Sr	87.61
Nitrogen	N	14.04	Sulphur	S	32.07
Osmium	Os	190.99	Tantalum	Ta	182.6
Oxygen	O	16.00	Tellurium	Te	127.0
Palladium	Pd	106.36	Terbium	Tb	160.0
Phosphorus	P	31.02	Thallium	Tl	204.15
Platinum	Pt	194.89	Thorium	Th	232.63
Potassium	K	39.11	Tin	Sn	119.05
Praseodymium	Prd	143.5	Titanium	Ti	48.15
Rhodium	Rh	103.01	Tungsten	W	184.84
Rubidium	Rb	85.43	Uranium	U	239.59
Ruthenium	Ru	101.68	Vanadium	V	51.38
Scandium	Sc	44.0	Ytterbium	Yt	173.0
Selenium	Se	79.0	Yttrium	Y	88.95
Silicon	Si	28.40	Zinc	Zn	65.41
Silver	Ag	107.92	Zirconium	Zr	90.6

Berzelius, in his electro-chemical hypothesis, distinguished certain relations between the different elements by the terms electro-negative and electro-positive. Later, the terms acidic and basic came into use. As synonymous with these, the terms negative and positive are now used, although they, like the others, are not free from objections.

From the combinations of the elements, the more negative uniting with the more positive in varying proportions and in groups of two, three, or more, all known compounds are produced. These unions take place in accordance with certain general chemical laws, the observation of which has given rise to the hypothesis that the elementary bodies are made up of indivisible particles, called atoms, and that chemical combination takes place through the union of these atoms. A group of atoms thus united is called a molecule.

All minerals are composed of either an element alone or two or more elements in combination. Elements are said to combine when, on bringing them together, a new substance is produced, differing from and possessing properties which, as a rule, are not the mean of those of its constituents. For example, the gases hydrogen and oxygen under the proper conditions combine to form water, a liquid. These combinations are represented symbolically by the juxtaposition of the symbols of the component elements. Thus, a molecule of water, composed of two atoms of hydrogen and one of oxygen, is represented by the symbol H_2O. The multiplication of a group of atoms is denoted by placing the proper numeral to the left of a group of symbols, or by inclosing them in parentheses and placing a small numeral to the right. Thus, $3H_2O$ or $(H_2O)_3$ denotes three molecules of water. The combination of groups is expressed by placing their symbols in juxtaposition with a period between them. Thus, $Fe_2O_3.H_2O$ denotes a compound of

oxygen and iron containing water. Sometimes the comma or the sign + is used in place of the period. Further, the letter R is used to denote a varying group of equivalent elements. Thus, $R\ Cb_2O_6$ is a compound in which there is a varying amount of the equivalent elements of the rare earths. R is also used as a general symbol for any element. These general principles are illustrated by the following series of labels and specimens showing the combinations of some typical elements:

Zinc and its combinations.—Zinc combines with sulphur to form the compounds sphalerite and wurtzite. Combined with oxygen it forms the compound zincite; with oxygen and other elements it forms a number of combinations. These oxygen compounds may be either oxidation products of zinc compounds alone, such as goslarite, $ZnSO_4.7H_2O$; adamite, $Zn_2(OH)AsO_4$; and smithsonite, $ZnCO_3$; or of zinc compounds in which there is some other base, as in köttigite $(Zn,Co)_3As_2O_8.8H_2O$, and aurichalcite $(Zn,Cu)_5(OH)_6(CO_3)_2$. Zinc combines with silicon and oxygen to form two well-defined compounds, willemite, Zn_2SiO_4, and calamine, $H_2Zn_2SiO_4$.

Examples.

Sphalerite—ZnS—Wheatley mine, Phœnixville, Pennsylvania. (Cat. No. 81829, U.S.N.M.)

Wurtzite—ZnS—Przibram, Bohemia. (Cat. No. 51476, U.S.N.M.)

Zincite—ZnO—Franklin, Sussex County, New Jersey. (Cat. No. 83614, U.S.N.M.)

Smithsonite—$ZnCO_3$—Altenberg, Belgium. (Cat. No. 51530, U.S.N.M.)

Aurichalcite—$(Zn,Cu)_5(OH)_6(CO_3)_2$—Empire mine, Joplin, Missouri. (Cat. No. 82198, U.S.N.M.)

Willemite—Zn_2SiO_4—Franklin, Sussex County, New Jersey. (Cat. No. 83615, U.S.N.M.)

Calamine—$H_2Zn_2SiO_4$—Sterling, Sussex County, New Jersey. (Cat. No. 81951, U.S.N.M.)

Descloizite—$(Zn,Pb)_2(OH)VO_4$—Commercial mine, Georgetown, New Mexico. (Cat. No. 48460, U.S.N.M.)

Adamite—$Zn_2(OH)AsO_4$—Laurium, Greece. (Cat. No. 48520, U.S.N.M.)

Tin and its combinations.—Tin occurs in combination with sulphur along with copper and iron in stannite, and with oxygen in cassiterite. These compounds, together with a few minerals in which the stannic compounds have been occluded and are present only as an impurity, are the only known occurrences of this element.

Examples.

Stannite—Cu_2FeSnS_4—St. Just, Cornwall, England. (Cat. No. 47028, U.S.N.M.)

Cassiterite—SnO_2—Graufen, Bohemia. (Cat. No. 45607, U.S.N.M.)

Lead and its combinations.—Lead unites with sulphur alone to form galena, and with sulphur and arsenic or antimony to form a number of compounds, of which dufrenoysite, $Pb_2As_2S_5$, and zinkenite, $PbSb_2S_4$, are examples. Combined with selenium or tellurium it is found in clausthalite, PbSe, and altaite, PbTe. It forms a number of combinations with oxygen. These oxygen compounds may be simple oxidation products of lead alone, such as massicot, PbO; plattnerite, PbO_2, and

minium, Pb_3O_4; or of lead compounds, such as anglesite, $PbSO_4$; melanotekite, $Pb_2Fe_2Si_2O_9$, and cerussite, $PbCO_3$. With chlorine it forms cotunnite, $PbCl_2$; with chlorine and oxygen or oxygen salts it forms oxychlorides and other salts of a mixed composition, such as chlorocarbonates and chloroarsenates.

Examples.

Galena—PbS—Mine La Motte, Missouri. (Cat. No. 45140, U.S.N.M.)

Altaite—PbTe—Cold Spring mine, Gold Hill, Colorado. (Cat. No. 13509, U.S.N.M.)

Jamesonite—$Pb_2Sb_2S_5$—Cornwall, England. (Cat. No. 12501, U.S.N.M.)

Freieslebenite—$(Pb,Ag_2)_5Sb_4S_{11}$—Garfield mine, Gunnison County, Colorado. (Cat. No. 82622, U.S.N.M.)

Cotunnite—$PbCl_2$—Vesuvius, Italy. (Cat. No. 13616, U.S.N.M.)

Plattnerite—PbO_2—"You Like" mine, Mullan, Idaho. (Cat. No. 48601, U.S.N.M.)

Cerussite—$PbCO_3$—County Yancowinna, New South Wales. (Cat. No. 82480, U.S.N.M.)

Melanotekite—$Pb_2Fe_2Si_2O_9$—Paisberg, Sweden. (Cat. No. 83544, U.S.N.M.)

Barysilite—$Pb_3Si_2O_7$—Harstig mine, Paisberg, Sweden. (Cat. No. 48970, U.S.N.M.)

Vanadinite—$(PbCl)Pb_4(VO_4)_3$—Yuma County, Arizona. (Cat. No. 48793, U.S.N.M.)

Endlichite—$(PbCl)Pb_4((As,V)O_4)_3$—Lake Valley, New Mexico. (Cat. No. 47082, U.S.N.M.)

Descloizite—$(Pb,Zn)_2(OH)VO_4$—Commercial mine, Georgetown, New Mexico. (Cat. No. 48691, U.S.N.M.)

Pyromorphite—$(PbCl)Pb_4(PO_4)_3$—Ems, Nassau, Germany. (Cat. No. 46998, U.S.N.M.)

Mimetite—$(PbCl)Pb_4(AsO_4)_3$—Cumberland, England. (Cat. No. 12571, U.S.N.M.)

Anglesite—$PbSO_4$—Monte Poni, Sardinia. (Cat. No. 51976, U.S.N.M.)

Crocoite—$PbCrO_4$—Berezov, Siberia. (Cat. No. 49581, U.S.N.M.)

Wulfenite—$PbMoO_4$—Red Cloud mine, Yuma County, Arizona. (Cat. No. 47978, U.S.N.M.)

Sulphur and its combinations.—Sulphur combines with the several metallic elements, forming a class of compounds of which realgar, AsS; stibnite, Sb_2S_3; molybdenite, MoS_2; sphalerite, ZnS, and chalcopyrite, $CuFeS_2$, are examples. Combined with the more positive metallic elements, and with arsenic, antimony, or bismuth, it forms a series of compounds such as cobaltite, CoAsS; arsenopyrite, $Fe\,As,S_2$; proustite, Ag_3AsS_3, and tetrahedrite, $Cu_8Sb_2S_7$. Finally, its combinations with the several elements unite more or less readily with oxygen, forming a number of oxidized species, such as barite, $BaSO_4$; selenite, $CaSO_4.2H_2O$, and brochantite, $Cu_4(OH)_6SO_4$.

Examples.

Orpiment—As_2S_3—Hernize, Bosnia, Turkey. (Cat. No. 18367, U.S.N.M.)

Stibnite—Sb_2S_3—Mine de Verde da Prota, Portugal. (Cat. No. 18292, U.S.N.M.)

Molybdenite—MoS_2—Altenberg, Saxony. (Cat. No. 8128, U.S.N.M.)

Sphalerite—ZnS—Cumberland, England. (Cat. No. 49585, U.S.N.M.)

Galena—PbS—Joplin, Missouri. (Cat. No. 51346, U.S.N.M.)

Cinnabar—HgS—Phœnix mine, Napa County, California. (Cat. No. 15985, U.S.N.M.)

Pyrrhotite—$Fe_{11}S_{12}$—Gap mine, Lancaster County, Pennsylvania. (Cat. No. 81841, U.S.N.M.)

Pyrite—FeS_2—Elba. (Cat. No. 49513, U.S.N.M.)

Chalcopyrite—$CuFeS_2$—Gordon mine, Yeoval, New South Wales. (Cat. No. 47996, U.S.N.M.)

Berthierite—$FeSb_2S_4$—Braunsdorf, Saxony. (Cat. No. 12997, U.S.N.M.)

Bournonite—$Pb_3Cu_2Sb_2S_6$—Kapnik, Hungary. (Cat. No. 45670, U.S.N.M.)

Tetrahedrite—$Cu_8Sb_2S_7$—Cornwall, England. (Cat. No. 14054, U.S.N.M.)

Tennantite—$Cu_8As_2S_7$—Cornwall, England. (Cat. No. 14081, U.S.N.M.)

Barite—$BaSO_4$—Westmoreland, England. (Cat. No. 49798, U.S.N.M.)

Celestite—$SrSO_4$—Girgenti, Sicily. (Cat. No. 49798, U.S.N.M.)

Anglesite—$PbSO_4$—Monte Poni, Sardinia. (Cat. No. 51976, U.S.N.M.)

Gypsum—$CaSO_4.2H_2O$—Hillsboro, New Brunswick. (Cat. No. 45705, U.S.N.M.)

Alunite—$K(AlO)_3(SO_4)_2.3H_2O$—Rosita Hills, Custer County, Colorado. (Cat. No. 51710, U.S.N.M.)

Brochantite—$Cu_4(OH)_6SO_4$—Horn silver mine, Frisco County, Utah. (Cat. No. 81120, U.S.N.M.)

Iron and its combinations.—The compounds of iron occur widely disseminated and in great numbers. Combined with sulphur, arsenic, and other elements it forms a number of compounds, such as pyrite, FeS_2; pyrrhotite, $Fe_{11}S_{12}$; chalcopyrite, $FeCuS_{12}$, and arsenopyrite, $Fe(As,S)_2$. With oxygen it forms anhydrous and hydrous compounds, such as hematite, Fe_2O_3, and limonite, $Fe_4O_3(OH)_6$. Alone or with other elements it enters into the composition of numerous oxidized species, as in siderite, $FeCO_3$; grünerite, $FeSiO_3$; tantalite, $FeTa_2O_6$; strengite, $FePO_4.2H_2O$; coquimibite, $(Fe,Al)_2(SO_4)_3.9H_2O$, and wolframite, $(Fe,Mn)WO_4$. Combined with chlorine it is found in lawrencite, $FeCl_2$, and molysite, $FeCl_3$.

Examples.

Pyrite—FeS_2—Mexico. (Cat. No. 8216, U.S.N.M.)

Marcasite—FeS_2—Cornwall, England. (Cat. No. 44358, U.S.N.M.)

Pyrrhotite—$Fe_{11}S_{12}$—Gap mine, Lancaster County, Pennsylvania. (Cat. No. 80811, U.S.N.M.)

Leucopyrite—Fe_3As_4—Ellenville, New York. (Cat. No. 81827, U.S.N.M.)

Arsenopyrite—$Fe(As,S)_2$—Freiberg, Saxony. (Cat. No. 82347, U.S.N.M.)

Hematite—Fe_2O_3—Elba. (Cat. No. 48469, U.S.N.M.)

Limonite—$Fe_4O_3(OH_6)$—Saxony. (Cat. No. 2321, U.S.N.M.)

Magnetite—Fe_3O_4—Mineville, Essex County, New York. (Cat. No. 50469, U.S.N.M.)

Chromite—$FeCr_2O_4$—Sonoma County, California. (Cat. No. 15972, U.S.N.M.)

Franklinite—$ZnFe_2O_4$—Franklin, Sussex County, New Jersey. (Cat. No. 47676, U.S.N.M.)

Siderite—$FeCO_3$—Freiberg, Saxony. (Cat. No. 49843, U.S.N.M.)

Chalcodite—$H_3(FeOH)_6Al(Si_3O_8)_3$—Antwerp, New York. (Cat. No. 47377, U.S.N.M.)

Columbite—$FeCb_2O_6$—Stoneham, Maine. (Cat. No. 13824, U.S.N.M.)

Tantalite—$FeTa_2O_6$—Etta mine, Pennington County, South Dakota. (Cat. No. 48355, U.S.N.M.)

Dufrenite—$Fe_5(OH)_6(PO_4)_3$—Rockbridge County, Virginia. (Cat. No. 82405, U.S.N.M.)

Strengite—$FePO_4.2H_2O$—Waldgirmes, Giessen, Germany. (Cat. No. 51621, U.S.N.M.)

Vivianite—$Fe_3P_2O_8.8H_2O$—Mullica Hill, New Jersey. (Cat. No. 45217, U.S.N.M.)

Eleonorite—$Fe_3(OH)_3(PO_4)_2.2\frac{1}{2}H_2O$—Waldgirmes, Giessen, Germany. (Cat. No. 47006, U.S.N.M.)

Cacoxenite—$Fe_2(OH)_3PO_4.4\frac{1}{2}H_2O$—Nobles mine, Lancaster County, Pennsylvania. (Cat. No. 4322, U.S.N.M.)

Scorodite—$FeAsO_4.2H_2O$—Red Mountain, Colorado. (Cat. No. 81190, U.S.N.M.)

Arseniosiderite—$FeCa_3(OH)_9AsO_4$—Romanèche, France. (Cat. No. 46376, U.S.N.M.)

Pharmacosiderite—$Fe_4(OH)_3(AsO_4)_3.6H_2O$—Mammoth mine, Tintic, Utah. (Cat. No. 51846, U.S.N.M.)

Coquimbite—$(Fe, Al)_2(SO_4)_3.9H_2O$—Tierra Amarillo, Chile. (Cat. No. 12548, U.S.N.M.)

Utahite—$Fe_3O_7H_5(FeOH)_3(SO_4)_3$—Eureka mine, Tintic, Utah. (Cat. No. 48241, U.S.N.M.)

Wolframite—$(Fe, Mn)WO_4$—Zinnwald, Bohemia. (Cat. No. 12262, U.S.N.M.)

Copper and its combinations.—Copper is rather abundantly distributed in a variety of forms. Combined with sulphur, either alone or with the sulphur compounds of other elements, it forms a variety of combinations, of which chalcocite, Cu_2S, and chalcopyrite, $CuFeS_2$, are examples. With arsenic and antimony, alone or with other elements, it forms compounds such as domeykite, Cu_3As, horsfordite, Cu_6Sb, and tetrahedrite, $Cu_8Sb_2S_7$. It forms a number of compounds with oxygen. These oxygen compounds may be simple oxidation products of copper, like cuprite, Cu_2O; or of copper compounds, such as atacamite, $Cu_2O_3H_3Cl$; malachite, $Cu_2(OH)_2CO_3$; chrysocolla, $H_2CuSiO_4.H_2O$; libethenite, $Cu_2(OH)PO_4$, and chalcanthite, $CuSO_4.5H_2O$.

Examples.

Chalcocite—Cu_2S—Cornwall, England. (Cat. No. 16980, U.S.N.M.)

Covellite—CuS—Moonta, South Australia. (Cat. No. 83607, U.S.N.M.)

Chalcopyrite—$CuFeS_2$—French Creek, Chester County, Pennsylvania. (Cat. No. 47973, U.S.N.M.)

Bornite—Cu_3FeS_3—Gilliss mine, Guilford County, North Carolina. (Cat. No. 51603, U.S.N.M.)

Domeykite—Cu_3As—Houghton, Portage Lake, Michigan. (Cat. No. 13377, U.S.N.M.)

Whitneyite—Cu_9As—Hancock, Portage Lake, Michigan. (Cat. No. 13375, U.S.N.M.)

Tetrahedrite—$Cu_8Sb_2S_7$—Moineberg, Germany. (Cat. No. 49549, U.S.N.M.)

Tennantite—$Cu_8As_2S_7$—Idaho Springs, Colorado. (Cat. No. 81818, U.S.N.M.)

Enargite—Cu_3AsS_4—Red Mountain, Colorado. (Cat. No. 81127, U.S.N.M.)

Atacamite—$Cu_2O_3H_3Cl$—Atacama, Chile. (Cat. No. 6510, U.S.N.M.)

Melaconite—CuO—Leavenworth mine, Central, Colorado. (Cat. No. 13599, U.S.N.M.)

Cuprite—Cu_2O—Copper Queen mine, Bisbee, Arizona. (Cat. No. 48780, U.S.N.M.)

Malachite—$Cu_2(OH)_2CO_3$—Copper Queen mine, Bisbee, Arizona. (Cat. No. 48773, U.S.N.M.)

Azurite—$Cu_3(OH)_2(CO_3)_2$—Detroit mine, Morenci, Arizona. (Cat. No. 83557, U.S.N.M.)

Dioptase—H_2CuSiO_4—Siberia. (Cat. No. 49373, U.S.N.M.)

Chrysocolla—$H_2CuSiO_4.H_2O$—French Creek, Chester County, Pennsylvania. (Cat. No. 46495, U.S.N.M.)

Libethenite—$Cu_2(OH)PO_4$—Libethen, Hungary. (Cat. No. 50966, U.S.N.M.)

Torbernite—$CuP_2O_8(UO_2)_2.8H_2O$—Cornwall, England. (Cat. No. 16811, U.S.N.M.)

Clinoclasite—$Cu_3(OH)_3AsO_4$—Mammoth mine, Tintic, Utah. (Cat. No. 48096, U.S.N.M.)

Olivenite—$Cu_2(OH)_3AsO_4$—Cornwall, England. (Cat. No. 45332, U.S.N.M.)

Conichalcite—$(Cu,Ca)_2(OH)AsO_4.\frac{1}{4}H_2O$—American Eagle mine, Tintic, Utah. (Cat. No. 48245, U.S.N.M.)

Erinite—$Cu_5(OH)_4As_2O_8$—Mammoth mine, Tintic, Utah. (Cat. No. 48114, U.S.N.M.)

Tyrolite—$Cu_5(OH)_4As_2O_8.7H_2O$—Mammoth mine, Tintic, Utah. (Cat. No. 4812, U.S.N.M.)

Chalcanthite—$CuSO_4.5H_2O$—Copiapo, Chile. (Cat. No. 12621, U.S.N.M.)

Brochantite—$Cu_4(OH)_6SO_4$—Mammoth mine, Tintic, Utah. (Cat. No. 48111, U.S.N.M.)

Silver and its combinations.—Silver, alone or with other elements, combines with sulphur, selenium, tellurium, arsenic, and antimony to form compounds, of which the following are examples: Argentite, Ag_2S, naumannite, Ag_2Se; hessite, Ag_2Te; huntilite, Ag_3As; dyscrasite, Ag_3Sb; proustite, Ag_3AsS_3, and pyrargyrite, Ag_3SbS_3. United with chlorine, bromine, or iodine it forms the minerals cerargyrite, AgCl; bromyrite, AgBr, and iodyrite, AgI. It does not unite with oxygen, and hence forms no oxygen compounds.

Examples.

Argentite—Ag_2S—Himmelsfürst mine, Freiberg, Saxony. (Cat. No. 49505, U.S.N.M.)

Stromeyerite—$(Ag,Cu)_2S$—Altai, Siberia. (Cat. No. 49126, U.S.N.M.)

Dyscrasite—Ag_3Sb—Cornwall, England. (Cat. No. 16952, U.S.N.M.)

Huntilite—Ag_3As—Isle Royale, Lake Superior. (Cat. No. 49354, U.S.N.M.)

Miargyrite—$AgSbS_2$—Saxony. (Cat. No. 42425, U.S.N.M.)

Stephanite—$Ag_{10}Sb_2S_8$—Reese River, Nevada. (Cat. No. 15133, U.S.N.M.)

Proustite—Ag_3AsS_3—Batopelas, Chihuahua, Mexico. (Cat. No. 81291, U.S.N.M.)

Pyrargyrite—Ag_3SbS_3—Bolivia. (Cat. No. 49887, U.S.N.M.)

Cerargyrite—AgCl—Lake Valley, New Mexico. (Cat. No. 47086, U.S.N.M.)

Bromyrite—AgBr—Broken Hill mine, New South Wales. (Cat. No. 51263, U.S.N.M.)

Iodyrite—AgI—Chañarcillo, Chile. (Cat. No. 13017, U.S.N.M.)

Gold and its combinations.—Gold is, with a few exceptions, found only in the native state, sometimes pure, but more often alloyed with silver or intimately mixed with other metallic elements or their compounds. In nature it combines with but one negative element, tellurium, forming the compounds sylvanite, $(Au,Ag)Te_2$; nagyagite, $Au_2Pb_{14}Sb_3(S,Te)_{24}$, and petzite, (Au,Ag)Te.

Examples.

Sylvanite—$(Au,Ag)Te_2$—Boulder County, Colorado. (Cat. No. 81145, U.S.N.M.)

Petzite—$(Au,Ag)_2Te$—Sunshine district, Boulder County, Colorado. (Cat. No. 9723, U.S.N.M.)

TYPES OF MINERALS.

The combinations of the several elements, together with such elements as may occur free, fall naturally in two classes—elements and compounds.

By a compound is meant that body produced by the combination of two or more elements, and which is different in its nature from, and whose properties as a rule are not the mean of, those of its constituents. A compound is to be distinguished from a mixture, or simple mechanical aggregation, in that it always implies a chemical union of its components, and therefore possesses a definite chemical composition.

Among minerals these two classes may be further divided in accord-

ance with chemical laws and grouped under certain prominent types as follows:

Native elements.—Of the seventy or more elements at present known to chemistry, but eighteen, excluding those occurring only in the gaseous state, are found native: carbon, sulphur, the metals of the platinum group, mercury, copper, silver, and gold are among these. With the native elements are included the native alloys or compounds and mixtures of elements belonging to the same groups in the periodic system.

The type is represented by the following specimens:

Graphite—Ceylon. (Cat. No. 81365, U.S.N.M.)
Sulphur—Cianciana, Sicily. (Cat. No. 51951, U.S.N.M.)
Selensulphur—White Islands, Bay of Plenty, New Zealand. (Cat. No. 48056, U.S.N.M.)
Tellurium—Keystone Lode, Boulder County, Colorado. (Cat. No. 9463, U.S.N.M.)
Arsenic—near Leadville, Colorado. (Cat. No. 81824, U.S.N.M.)
Allemontite—Allemont, France. (Cat. No. 46395, U.S.N.M.)
Antimony—Prince William, New Brunswick. (Cat. No. 45704, U.S.N.M.)
Bismuth—Schneeberg, Saxony. (Cat. No. 45415, U.S.N.M.)
Iron—Ovifak, Disco Island, Greenland. (Cat. No. 47480, U.S.N.M.)
Copper—Ontonagon County, Michigan. (Cat. No. 18227, U.S.N.M.)
Silver—Freiberg, Saxony. (Cat. No. 49478, U.S.N.M.)
Gold—California. (Cat. No. 81429, U.S.N.M.)

Fluorides, chlorides, bromides, and iodides.—The halogens, fluorine, chlorine, bromine, and iodine, form simple and complex compounds with other elements. The halides, as these compounds are called, are divided chemically into four classes—fluorides, chlorides, bromides, and iodides—according to the nature of the negative constituent. Two of the halogens—fluorine and chlorine—enter into the composition of several oxidized species, called, respectively, oxyfluorides and oxychlorides—compounds in which there is a metallic fluoride or chloride with a basic oxide of the same metal.

The following specimens are representatives of these types:

Fluorite—England. (Cat. No. 49603, U.S.N.M.)
Cryolite—Evigtok, Arksut-fiord, Greenland. (Cat. No. 46271, U.S.N.M.)
Pachnolite—Evigtok, Arksut-fiord, Greenland. (Cat. No. 17895, U.S.N.M.)
Thomsenolite—Evigtok, Arksut-fiord, Greenland. (Cat. No. 81696, U.S.N.M.)
Gearksutite—St. Peters Dome, Pikes Peak, Colorado. (Cat. No. 48222, U.S.N.M.)
Halite—Lincoln County, Nevada. (Cat. No. 15475, U.S.N.M.)
Cerargyrite—Chañarcillo, Chile. (Cat. No. 13018, U.S.N.M.)
Carnallite—Stassfurt, Germany. (Cat. No. 83908, U.S.N.M.)
Tachhydrite—Stassfurt, Germany. (Cat. No. 83912, U.S.N.M.)
Bromyrite—Broken Hill mine, New South Wales. (Cat. No. 51262, U.S.N.M.)
Atacamite—Huasco, Chile. (Cat. No. 16956, U.S.N.M.)

Sulphides, selenides, and tellurides.—The elements sulphur, selenium, and tellurium bear a marked resemblance to each other, and present close analogies in their properties, occurrence, and mode of combining with other elements. The terms sulphide, selenide, and telluride include all those compounds in which sulphur, selenium, or tellurium

forms the negative part. These three elements combine in this manner with most of the metals. Further, the three negative elements are essentially isomorphous, and may replace each other in varying amounts.

These types are illustrated by the following specimens:

Orpiment—Sunshine mine, Sunshine, Utah. (Cat. No. 84027, U.S.N.M.)
Molybdenite—Hallein, Austria. (Cat. No. 49904, U.S.N.M.)
Sphalerite—Cumberland, England. (Cat. No. 49585, U.S.N.M.)
Millerite—Gap mine, Lancaster County, Pennsylvania. (Cat. No. 48214, U.S.N.M.)
Galena—Joplin, Missouri. (Cat. No. 51346, U.S.N.M.)
Covellite—Gray Rock mine, Butte, Montana. (Cat. No. 84071, U.S.N.M.)
Cinnabar—Idria, Spain. (Cat. No. 81728, U.S.N.M.)
Argentite—Guanajuato, Mexico. (Cat. No. 84057, U.S.N.M.)
Chalcocite—Cornwall, England. (Cat. No. 16981, U.S.N.M.)
Pyrrhotite—Ashe County, North Carolina. (Cat. No. 46236, U.S.N.M.)
Linnæite—Mine La Motte, Missouri. (Cat. No. 45143, U.S.N.M.)
Pyrite—Central, Colorado. (Cat. No. 81844, U.S.N.M.)
Chalcopyrite—Gap mine, Lancaster County, Pennsylvania. (Cat. No. 48216, U.S.N.M.)
Bornite—Freiberg, Saxony. (Cat. No. 49473, U.S.N.M.)
Tiemannite—Marysvale, Utah. (Cat. No. 81821, U.S.N.M.)
Henryite—Red Cloud mine, Gold Hill, Colorado. (Cat. No. 9705, U.S.N.M.)
Sylvanite—Offenbanya, Hungary. (Cat. No. 9719, U.S.N.M.)

Arsenides antimonides, and bismuthides.—Arsenic, antimony, and bismuth are analogous in their properties, and unite with other elements to form arsenides, antimonides, and bismuthides. Arsenic and antimony, and, to a certain extent, bismuth, are essentially isomorphous, and may replace one another in varying amounts. With the arsenides, antimonides, and bismuthides are included the sulpharsenides, sulphantimonides, and sulphbismuthides—compounds in which the negative part is taken by arsenic, antimony, or bismuth with sulphur.

The following specimens are illustrative of these types:

Niccolite—Gem mine, Silver Cliff, Colorado. (Cat. No. 51465, U.S.N.M.)
Löllingite—Horace Porter mine, Gunnison County, Colorado. (Cat. No. 51566, U.S.N.M.)
Cobaltite—Coquimbo, Chile. (Cat. No. 13372, U.S.N.M.)
Arsenopyrite—Rockbridge County, Virginia. (Cat. No. 13982, U.S.N.M.)

Sulphosalts.—This class includes the various native salts of the sulphoacids of arsenic, antimony, bismuth, tin, and germanium. The elements present as bases are chiefly lead, copper, and silver; less often iron, mercury, zinc, etc. The several compounds are arranged with reference to their negative parts as follows: Sulpharsenites, sulphantimonites, and sulphbismuthites; sulpharsenates, sulphantimonates, sulphstannates, and sulphgermanates.

Examples of these are shown in the specimens of—

Chalcostibite—St. Gertraad, Carinthia, Austria. (Cat. No. 84088, U.S.N.M.)
Freieslebenite—Garfield mine, Gunnison County, Colorado. (Cat. No. 82622, U.S.N.M.)
Pyrargyrite—Yankee Boy mine, Ouray, Colorado. (Cat. No. 81122, U.S.N.M.)
Tetrahedrite—Freiberg, Saxony. (Cat. No. 45656, U.S.N.M.)
Tennantite—Freiberg, Saxony. (Cat. No. 49486, U.S.N.M.)

Stephanite—Freiberg, Saxony. (Cat. No. 49486, U.S.N.M.)

Richmondite—Richmond Hill, Collingwood, New Zealand. (Cat. No. 48039, U.S.N.M.)

Polybasite—Della S. mine, Aspen, Colorado. (Cat. No. 81037, U.S.N.M.)

Enargite—Missouri mine, Park County, Colorado. (Cat. No. 51488, U.S.N.M.)

Stannite—Cornwall, England. (Cat. No. 43623, U.S.N.M.)

Kylindrite—Poopo, Bolivia. (Cat. No. 84059, U.S.N.M.)

Argyrodite—Freiberg, Saxony. (Cat. No. 52131, U.S.N.M.)

Oxysulphides.—The minerals here included are those sulphides in which the sulphur is in part replaced by oxygen—that is, compounds of sulphides and oxides.

The type is illustrated by—

Kermesite—South Ham, Quebec, Canada. (Cat. No. 46870, U.S.N.M.)

Oxides and oxygen salts.—From the abundance of oxygen and its nearly universal affinities, its combinations form by far the largest number of the compounds of the elements. The minerals of this class fall into two general groups—the oxides of the elements and their combinations. To the first group the general name oxides is given; to the second, oxygen salts. The oxygen salts include a number of types of minerals, such as carbonate, silicate, and phosphate.

The type oxide is represented by the following specimens:

Cervantite—Fords Creek, near Gulzora, New South Wales. (Cat. No. 82476, U.S.N.M.)

Zincite—Franklin, Sussex County, New Jersey. (Cat. No. 50230, U.S.N.M.)

Hematite—Elba. (Cat. No. 16474, U.S.N.M.)

Quartz—Buncombe County, North Carolina. (Cat. No. 45841, U.S.N.M.)

Rutile—Magnet Cove, Arkansas. (Cat. No. 50530, U.S.N.M.)

Limonite—Saxony. (Cat. No. 2029, U.S.N.M.)

Brucite—Texas, Lancaster County, Pennsylvania. (Cat. No. 49613, U.S.N.M.)

Hydrotalcite—Snarum, Norway. (Cat. No. 49026, U.S.N.M.)

Oxygen salts, borates, aluminates, chromites, ferrites, and manganites.—Borontrioxide, B_2O_3, under the proper conditions, will combine with other oxides to form borates. Alumina, Al_2O_3, acts with oxides of stronger bases as an acid-forming oxide, and unites with them to form aluminates. Chromic oxide, Cr_2O_3, and ferric oxide, Fe_2O_3, unite with oxides of stronger bases to form chromites and ferrites. Oxide of manganese, Mn_2O_3, acts as an acid-forming oxide toward stronger bases, and forms with them manganates.

The following specimens are illustrative of these types:

Ulexite—Columbus, Nevada. (Cat. No. 14379, U.S.N.M.)

Sussexite—Franklin, Sussex County, New Jersey. (Cat. No. 47513, U.S.N.M.)

Colemanite—Near Calico, San Bernardino County, California. (Cat. No. 47571, U.S.N.M.)

Chrysoberyl—Haddam, Connecticut. (Cat. No. 13370, U.S.N.M.)

Spinel—Southfield, Orange County, New York. (Cat. No. 46546, U.S.N.M.)

Chromite—Zanina, Turkey. (Cat. No. 18370, U.S.N.M.)

Magnetite—Orange County, New York. (Cat. No. 46546, U.S.N.M.)

Franklinite—Franklin, Sussex County, New Jersey. (Cat. No. 16529, U.S.N.M.)

Braunite—Jakobsberg, Sweden. (Cat. No. 47444, U.S.N.M.)

Psilomelane—Romanèche, France. (Cat. No. 46375, U.S.N.M.)

Oxygen salts, carbonates.—The carbonates—compounds of carbon dioxide with other oxides—form a numerous and important class of minerals. They may be conveniently arranged as follows: Normal carbonates, compounds in which the ratio of oxygen in the carbon dioxide to the oxygen in the combined oxide is as 2:1; basic carbonates, compounds in which the ratio of the number of the oxygen atoms to that of the combined oxide is less than 2:1; fluo and chloro carbonates, compounds in which there is a fluoride or chloride with a carbonate of the same element.

The following specimens are of this type:

Calcite—Waldshut, Germany. (Cat. No. 2016, U.S.N.M.)
Smithsonite—Joplin, Missouri. (Cat. No. 48638, U.S.N.M.)
Malachite—Nizne-Tagilsk, Siberia. (Cat. No. 49401, U.S.N.M.)
Azurite—Copper Queen mine, Bisbee, Arizona. (Cat. No. 48769, U.S.N.M.)
Phosgenite—Monte Poni, Sardinia. (Cat. No. 51948, U.S.N.M.)

Oxygen salts, silicates.—The silicates—compounds of silicon oxides with other oxides—constitute about nine-tenths of the known crust of the earth and more than one-fourth of the known kinds of minerals. Isomorphic combinations are the rule, and as a class they exhibit great diversity of composition. For example, the ratio of oxygen in silica to that in combined oxide may vary for monad and dyad elements, such as potassium or calcium, between 2:4 and 4:1; and for silicates of triad elements, such as aluminum or iron, between 2:6 and 12:3. Again, it is not unusual to find a silicate containing both potassium and calcium as oxides combined with silica, or the oxides of iron and aluminum, or of calcium and aluminum, and that not necessarily in atomic proportion. But, although certain oxides are capable of mutual replacement in any and all proportions, such as the sesquioxides of iron, aluminum, etc., or the monoxides of calcium, magnesium, iron, manganese, sodium, lithium, etc., and though a silicate may contain at once a mixture of sesquioxides and monoxides in combination with silica, the place of a monoxide is not taken by a sesquioxide nor that of a sesquioxide by a monoxide.

Examples of this type are shown in the following specimens:

Pyroxene—Grasse Lake, St. Lawrence County, New York. (Cat. No. 48292, U.S.N.M.)
Hornblende—Wolfsberg, Bohemia. (Cat. No. 50604, U.S.N.M.)
Beryl—Portland, Connecticut. (Cat. No. 81987, U.S.N.M.)
Feldspar—Diana, Lewis County, New York. (Cat. No. 50876, U.S.N.M.)
Garnet—Upland, Delaware County, Pennsylvania. (Cat. No. 51982, U.S.N.M.)
Topaz—Stoneham, Maine. (Cat. No. 28915, U.S.N.M.)
Calamine—Sterling Hill, Sussex County, New Jersey. (Cat. No. 14416, U.S.N.M.)
Tourmaline—Macomb, St. Lawrence County, New York. (Cat. No. 48280, U.S.N.M.)
Stilbite—Cape D'Or, Minas Basin, Nova Scotia. (Cat. No. 83415, U.S.N.M.)
Muscovite—Chester County, Pennsylvania. (Cat. No. 83478, U.S.N.M.)
Serpentine—Montville, New Jersey. (Cat. No. 47544, U.S.N.M.)
Kaolin—Rio Francisco, Arizona. (Cat. No. 8879, U.S.N.M.)
Genthite—Webster, Jackson County, North Carolina. (Cat. No. 44475, U.S.N.M.)

Oxygen salts, titanates.—The titanates—compounds of oxides with oxides whose negative portion is made up solely or chiefly of titanium oxide—may be arranged under the following groups: Titanates, compounds whose negative portion is titanium oxide; titanosilicates, compounds whose negative portion is compounded of titanic and silicic oxides; columbotitanates, including those compounds intermediate between the titanates and the succeeding columbates, and whose negative parts may consist of the oxide of titanium with the oxides of columbium or silicon, with zirconium, etc.

Examples.

Ilmenite—Chester County, Pennsylvania. (Cat. No. 49959, U.S.N.M.)
Titanite—Renfrew County, Canada. (Cat. No. 46566, U.S.N.M.)
Hydrotitanite—Magnet Cove, Arkansas. (Cat. No. 45259, U.S.N.M.)

Oxygen salts, columbates and tantalates.—The columbates and tantalates include those compounds of oxides with oxides whose negative parts are taken by the oxides of columbium or tantalum. The intimate relations existing between these compounds require them to be grouped together, there being, in fact, but few native tantalates that do not contain more or less columbium.

Examples.

Columbite—Peru, Maine. (Cat. No. 46854, U.S.N.M.)
Samarskite—Wiseman mine, Mitchell County, North Carolina. (Cat. No. 51222, U.S.N.M.)
Tantalite—Coosa County, Alabama. (Cat. No. 45846, U.S.N.M.)

Oxygen salts, nitrates.—The nitrates—compounds of oxides with oxides whose negative portion is nitrogen pentoxide—are few and are chiefly salts of sodium, potassium, calcium, and magnesium. There is a single hydrous basic cuprous species and a few double salts.

Examples.

Sodaniter—Chile. (Cat. No. 83227, U.S.N.M.)

Oxygen salts, vanadates.—Under this head are included those minerals in which vanadium pentoxide constitutes the negative portion. The principal vanadates are vanadinite, a combination of a lead vanadate with a chloride of the same metal, and descloizite, a basic lead vanadate carrying zinc.

Examples.

Vanadinite—Aqua Fria mine, Yavapai County, Arizona. (Cat. No. 48711, U.S.N.M.)
Descloizite—Commercial mine, Georgetown, New Mexico. (Cat. No. 48458, U.S.N.M.)

Oxygen salts, phosphates.—Under this head are included the native oxydized compounds of phosphorus, which are without exception compounds of oxides with phosphorus pentoxide. The majority of these compounds are either isomorphous modifications or basic salts, both

anhydrous and hydrous. The phosphates may crystallize with a fluoride as in apatite, with a chloride as in pyromorphite, or with a hydroxyl as in triploidite.

The following are examples of this type:

Monazite—Burke County, North Carolina. (Cat. No. 49463, U.S.N.M.)
Apatite—Hammond, St. Lawrence County, New York. (Cat. No. 49780, U.S.N.M.)
Pyromorphite—Wheatley mine, Phoenixville, Pennsylvania. (Cat. No. 12572, U.S.N.M.)
Triploidite—Branchville, Connecticut. (Cat. No. 49576, U.S.N.M.)
Variscite—Montgomery County, Arkansas. (Cat. No. 45194, U.S.N.M.)
Cacoxenite—Nobles mine, Lancaster County, Pennsylvania. (Cat. No. 49075, U.S.N.M.)
Autunite—Stoneham, Maine. (Cat. No. 45795, U.S.N.M.)

Oxygen salts, arsenates.—The arsenates include all those compounds of oxides with oxides whose negative parts are taken by arsenic pentoxide. The arsenates are similar to the phosphates in molecular structure, and, like them, the majority are either isomorphic modifications or basic salts, both with and without water of crystallization. Further, they may consist of a combination of a chloride, fluoride, or hydroxyl with an arsenate. As a class they present many analogies to the phosphates, and like salts, as a rule, are isomorphous. The few rare native antimonates, together with chloriferous antimonites and arsenites, are here included with the arsenates.

Examples of this type are shown in the following specimens:

Mimetite—Leadville, Colorado. (Cat. No. 51362, U.S.N.M.)
Tyrolite—Mammoth mine, Tintic, Utah. (Cat. No. 48121, U.S.N.M.)
Conichalcite—American Eagle mine, Tintic, Utah. (Cat. No. 48244, U.S.N.M.)
Scorodite—Red Mountain, Colorado. (Cat. No. 81190, U.S.N.M.)

Oxygen salts, sulphates.—The sulphates—compounds of oxides with oxides in which the sole or principal negative constituent is sulphur trioxide—may be simple or isomorphic combinations or basic salts, either anhydrous or hydrous. They may also crystallize with chlorides or carbonates. The few native tellurates and selenates, compounds analogous to the sulphates, whose negative parts are respectively taken by telluric or selenic oxide, together with those compounds in which the more negative part is taken by either tellurous or selenous oxide, are here grouped with the sulphates.

The following specimens are examples of this type:

Barite—Dufton, England. (Cat. No. 49799, U.S.N.M.)
Selenite—Fort Ellsworth, Kansas. (Cat. No. 82376, U.S.N.M.)
Brochantite—United Verde mine, Yavapai County, Arizona. (Cat. No. 48784, U.S.N.M.)
Alunite—Rosita Hills, Custer County, Colorado. (Cat. No. 51710, U.S.N.M.)
Alunogen—Esmeralda County, Nevada. (Cat. No. 17643, U.S.N.M.)
Hanksite—San Bernardino County, California. (Cat. No. 81217, U.S.N.M.)

Oxygen salts, chromates.—The chromates—compounds of chromium trioxide with other oxides—are isomorphous with the corresponding sulphates. The class has but few representatives among minerals.

Examples.

Crocoite—Berezov, Siberia. (Cat. No. 49581, U.S.N.M.)
Vauquelinite—Berezov, Siberia. (Cat. No. 45289, U.S.N.M.)

Oxygen salts, molybdates and tungstates.—The molybdates and tungstates—compounds of oxides with oxides whose negative parts are taken by molybdenum or tungsten trioxide—are few, there being, in fact, about a dozen kinds only of minerals of this class.

Examples.

Wulfenite—North Star mine, Lucien district, Elko County, Nevada. (Cat. No. 15981, U.S.N.M.)
Wolframite—Zinnwald, Saxony. (Cat. No. 8133, U.S.N.M.)
Hübnerite—North Star mine, Silverton, Colorado. (Cat. No. 81150, U.S.N.M.)
Scheelite—near Santiago, Chile. (Cat. No. 6992, U.S.N.M.)

Oxygen salts, uranates.—The uranates—compounds of the oxides of uranium with other oxides—are very complex in composition. They contain, in addition to the oxides of uranium, the oxides of thorium, zirconium, yttrium, and the cerium metals. Certain of the uranates also contain nitrogen, argon, and helium in an unknown state of combination.

The type is represented by:

Uraninite—Wood mine, Central, Colorado. (Cat. No. 83759, U.S.N.M.)

Compounds of organic origin.—This class includes the native salts of organic acids such as the oxalates and mellates, the oxygenated hydrocarbons, as the ambers and various fossil resins, together with the numerous carbon compounds like the petroleums, asphaltums, and mineral coals, which are, in general, simply mixtures.

Examples.

Whewellite—Zwickau, Saxony. (Cat. No. 1920, U.S.N.M.)
Mellite—Russia. (Cat. No. 1219, U.S.N.M.)
Amber—Baltic Sea. (Cat. No. 15009, U.S.N.M.)
Petroleum—Pennsylvania. (Cat. No. 50409, U.S.N.M.)
Asphaltum—Trinidad. (Cat. No. 50410, U.S.N.M.)
Uintahite—Uinta Valley, Utah. (Cat. No. 50411, U.S.N.M.)
Coal—Pennsylvania. (Cat. No. 50509, U.S.N.M.)

VARIATIONS IN COMPOSITION.

A mineral is primarily a body having a certain and definite chemical composition. This ideal condition is not always present, and the composition of any one species may vary within wide limits. This variation in composition may be due to: Original mixtures—that is, when two or more minerals are so intimately mixed that the mass appears uniform: metasomatosis, in which a mineral originally homogeneous may be partially altered by a process of "indefinite substitution and replacement:" chemical substitution, in which there has been a complete or partial substitution of one or more elements for

another. The specimen of emery (Cat. No. 18117, U.S.N.M.) is a mixture in variable proportions of corundum, oxide of aluminum, with magnetite, oxide of iron. The next specimen (Cat. No. 35943, U.S.N.M.), known as red felsite, is a feldspar mixed with quartz and other minerals and is the result of a melting together of the original minerals. The next (Cat. No. 49085, U.S.N.M.) is an intimate mixture of zircon, thorite, and limonite.

The specimens of pyrite altering to limonite (Cat. No. 13577, U.S.N.M.), of corundum to damourite (Cat. No. 49611, U.S.N.M.), of almandite to chlorite (Cat. No. 81216, U.S.N.M.), of iolite to chlorophyllite (Cat. No. 82456, U.S.N.M.), and of pyroxene to serpentine (Cat. No. 39327, U.S.N.M.) show some of the variations resulting from metasomatosis. The important instances of variable composition due to chemical substitution are illustrated by several series of minerals, among which may be noted the amphiboles, tremolite, $CaMg_3(SiO_3)_4$; actinolite, $Ca(Mg,Fe)_3(SiO_3)_4$; cummingtonite $(Fe,Mg)SiO_3$, and grünerite, $FeSiO_3$, in which the calcium and magnesium are gradually replaced by iron.

RELATION OF WATER TO COMPOSITION.

Water is an important constituent of many minerals, and is contained in them in a variety of forms. It may exist as water of crystallization, that is, simply as water; or as water of constitution, that is, as hydrogen and oxygen in the relative proportions to form water, though probably not actually existing as such. In the first instance the water is readily expelled from the mineral on heating; and the proportion of water so occurring is fixed, each molecule of the anhydrous substance being combined with some definite number of molecules of water. In the second case the mineral usually yields water only at a high temperature or on continued heating, and the water so occurring probably does not exist as such, but rather as its elements; the compound is broken up by heat with the liberation of basic hydrogen which combines with oxygen to form water. Finally water may combine with the same anhydrous substance in several different proportions to form as many different compounds. These relations are illustrated by the next series of twenty-four specimens.

RELATION OF WATER TO PHYSICAL PROPERTIES.

Water, when combined as such in definite equivalent proportions, may vary in amount according to the physical conditions under which the compound separates from solution. The water thus contained often has a great influence on the physical properties of the substance. Thus borax at ordinary temperatures separates from solution with four and a half parts of water and crystallizes in oblique rhombic prisms; at 80° it separates with two parts of water and crystallizes in octahedrons. In some cases the water is so feebly combined that it gradually separates when the compound is exposed to dry air, the sub-

stance at the same time losing its crystalline form and falling to powder; in other cases the compound may absorb water from moist air to such an extent as to form a solution. These conditions are respectively known as efflorescence and deliquescence. Further, the presence of water combined with a salt often influences its color; and finally, those minerals containing water are, as a rule, lighter and softer than anhydrous minerals of an otherwise similar composition.

These effects are illustrated by a series of pairs of minerals and laboratory compounds, each pair consisting of analagous hydrous and anhydrous compounds, the differences in each case being stated on the accompanying label.

RELATION OF COMPOSITION TO PHYSICAL PROPERTIES.

The comparison of almost any mineral with the elements of which it is composed shows that its more fundamental properties, such as specific gravity, luster, etc., are, to a limited extent, the average of those of its constituent elements. Three series of specimens illustrative of this are shown.

I. Density series: This series illustrates the relations between the specific gravity of minerals and their composition. Those minerals in which the heavy elements predominate are themselves heavy; and those composed chiefly of the lighter elements have a correspondingly low specific gravity.

II. Magnetism series: Those minerals which are magnetic are rich in the magnetic elements, and their magnetic properties increase with the increase of their magnetic constituents.

III. Luster series: Those minerals in which elements having a metallic luster predominate usually possess a metallic luster; and those composed chiefly of the nonmetallic elements have a nonmetallic luster.

These relations are illustrated by the following series of minerals:

I. DENSITY SERIES.

Galena, density 7.6, composed chiefly of the heavy element lead. Utah. (Cat. No. 18213, U.S.N.M.)

Cinnabar, density 8.2, composed chiefly of the heavy element mercury. Mercur mine, Mercur, Utah. (Cat. No. 81321, U.S.N.M.)

Chalcopyrite, density 4.3, composed chiefly of the heavy elements copper and iron. Copiapo, Chile. (Cat. No. 12989, U.S.N.M.)

Wulfenite, density 7, contains the heavy element lead. Eureka County, Nevada. (Cat. No. 15923, U.S.N.M.)

Bauxite, density 2.5, composed chiefly of the light element aluminum. Bartow County, Georgia. (Cat. No. 83239, U.S.N.M.)

Kaolin, density 2.5, contains the light element aluminum. Aiken, Aiken County, South Carolina. (Cat. No. 10694, U.S.N.M.)

Quartz, density 2.6, composed chiefly of the light element silicon. Crystal Mountain, Arkansas. (Cat. No. 45885, U.S.N.M.)

Magnesite, density 3.4, composed chiefly of the light element magnesium. Napa County, California. (Cat. No. 18710, U.S.N.M.)

II. MAGNETISM SERIES.

Magnetite, contains the magnetic element iron. Magnet Cove, Arkansas. (Cat. No. 27291, U.S.N.M.)

Pyrrhotite, contains the magnetic element iron. Gap mine, Lancaster County, Pennsylvania. (Cat. No. 39391, U.S.N.M.)

Hematite, contains the magnetic element iron. Marquette, Michigan. (Cat. No. 18142, U.S.N.M.)

Galena, nonmagnetic, contains the nonmagnetic element lead. Joplin, Missouri. (Cat. No. 18165, U.S.N.M.)

Corundum, nonmagnetic, contains the nonmagnetic element aluminum. Powder Springs, Cobb County, Georgia. (Cat. No. 46256, U.S.N.M.)

Azurite, nonmagnetic, contains the nonmagnetic element copper. Copper Queen mine, Bisbee, Arizona. (Cat. No. 83753, U.S.N.M.)

III. LUSTER SERIES.

Galena, metallic, composed chiefly of metallic elements. Utah. (Cat. No. 18213, U.S.N.M.)

Pyrite, metallic, composed chiefly of metallic elements. Central, Colorado. (Cat. No. 51364, U.S.N.M.)

Stibnite, metallic, composed chiefly of metallic elements. Hill Grove, New South Wales. (Cat. No. 82475, U.S.N.M.)

Pyrrhotite, metallic, composed chiefly of metallic elements. Gap mine, Lancaster County, Pennsylvania. (Cat. No. 39391, U.S.N.M.)

Albite, nonmetallic, composed chiefly of nonmetallic elements. Amelia Courthouse, Virginia. (Cat. No. 48723, U.S.N.M.)

Muscovite, nonmetallic, composed chiefly of nonmetallic elements. Chester County, Pennsylvania. (Cat. No. 83478, U.S.N.M., the Lea collection.)

Magnesite, nonmetallic, composed chiefly of nonmetallic elements. Gilroy, California. (Cat. No. 16070, U.S.N.M.)

II. PHYSICAL MINERALOGY.

A—PROPERTIES RELATING TO FORM OR MOLECULAR STRUCTURE.

THE CRYSTAL.

Substances which are chemically homogeneous, when they solidify from a state of vapor, solution, or fusion, tend to assume certain regular forms as a result of mathematical symmetry in the action of cohesive attraction. The forms produced are regularly bounded solids, called crystals. Crystals are bounded by plane surfaces, called planes or faces, symmetrically arranged with reference to and whose position in a given crystal is related in some simple ratio to the relative lengths of one or more diametral lines called axes. The angles of a crystal are of two kinds, interfacial and solid. The interfacial angle is that formed by the intersection of two crystal planes, and the line of such an intersection is called an edge. The solid angle is that formed by the intersection of three or more crystal faces. The angles or edges of a crystal are often replaced by one or more planes. When an edge is replaced by a single plane it is said to be truncated; a replacement by two similar planes is a bevelment. Further, the corresponding angles

between the faces of different crystals of the same substance are essentially constant. These features of a crystal are illustrated by a series of specimens and models.

CRYSTALLOGRAPHIC AXES.

The crystallographic axes are imaginary straight lines passing through the center of a crystal. They are assumed as axes in order to describe by reference to them the relative positions of the different planes. One of the axes is called the vertical, the other two or three the lateral. They may be of equal or unequal lengths, and may intersect at either right or oblique angles. The relative positions and inclinations of the planes of crystals are expressed by referring them to systems of axes. They are:

Isometric.—Three equal and interchangeable axes (a) which intersect at angles of 90 degrees.

Tetragonal.—Two equal and interchangeable lateral axes (a) at 90 degrees to each other, and one unequal and dissimilar vertical axis (c) at right angles to them.

Hexagonal.—Three equal and interchangeable lateral axes (a) intersecting each other at angles of 60 degrees. One unequal and dissimilar axis, a vertical (c), at 90 degrees to the others.

Orthorhombic.—Three unequal and not interchangeable axes at 90 degrees to each other. Any one of the three directions may be made the vertical axis (c). Conventionally the longer lateral axis (b) is placed horizontally from right to left and is called the macrodiagonal; while the shorter lateral axis (a), which runs from back to front, is called the brachydiagonal.

Monoclinic.—Three unequal and not interchangeable axes, two of which (a and c) lie at an angle β to each other. The third axis (b) is at 90 degrees to both a and c. Conventionally, c is placed vertically, b horizontally from right to left, and is called the orthodiagonal, while a, the oblique axis, is called the clinodiagonal.

Triclinic.—Three unequal and not interchangeable axes at oblique angles, α, β, γ, to each other. Any one of the three directions may be taken as the vertical (c). The longer of the two remaining axes, the macrodiagonal (b), inclines downward toward the right, and the shorter, the brachydiagonal (a), downward toward the front.

CRYSTAL FORM.

The term "crystal form" is defined as: The sum of all possible planes bounding a crystal which are geometrically and physically equal. Crystal forms are of three types: Pinacoids, composed of planes parallel to two axes. Prisms and domes, forms whose planes intersect two axes and are parallel to a third. Pyramids, forms whose planes cut all three axes.

Crystal forms may be simple or in combination. Simple forms are

those which contain similar planes only. Combinations are those in which dissimilar planes occur, and are made up of those simple forms which would result from the extension of one set of similar planes till the others disappear. In certain compounds only complete forms occur; in others crystal faces occur which correspond in position to planes of complete forms, but there has been a regular suppression of one-half to three-quarters of the required number of planes. These conditions are known respectively as holohedral, hemihedral, and tetartohedral according as there is the full, one-half, or one-quarter of the required number of planes present.

The number of possible combinations of crystal forms is large; but they may all be grouped under six systems.

CRYSTAL SYSTEMS.

"A system is the sum of all the possible crystal forms whose planes can be referred to the same kinds of axes." The systems of crystallization are: (1) Isometric; (2) tetragonal; (3) hexagonal; (4) orthorhombic; (5) monoclinic; (6) triclinic. The first system includes all forms referable to three axes of equal length which intersect at angles of 90 degrees. The second and third systems include all forms referable to one principal or vertical axis which is perpendicular to and different in length from the lateral axes. The fourth, fifth, and sixth include those forms having no principal axis.

Isometric system.—Includes all forms referable to three axes of equal length, and which intersect at angles of 90 degrees.

Examples:

The octahedron: Fluorite, Jefferson County, New York (Cat. No. 49947, U.S.N.M.); magnetite, Lake Itkul, Russia (Cat. No. 49366, U.S.N.M.).

The cube: Pyrite, Fishkill, New York (Cat. No. 14136, U.S.N.M.); fluorite, Weardale, England (Cat. No. 49597, U.S.N.M.); galena, Mineral Point, Wisconsin (Cat. No. 49110, U.S.N.M.).

The dodecahedron: Garnet, Salida, Chaffee County, Colorado (Cat. No. 81216, U.S.N.M.); almandite, Tyrol (Cat. No. 82462, U.S.N.M.); grossularite, Xaloostoc, Morelos, Mexico (Cat. No. 50116, U.S.N.M.).

The ikositetrahedron: Garnet, Burke County, North Carolina (Cat. No. 81402, U.S.N.M.); leucite, Vesuvius, Italy (Cat. No. 16692, U.S.N.M.); analcite, Pinnacle Island, Minas Basin, Nova Scotia (Cat. No. 49457, U.S.N.M.).

Combination of the octahedron and cube: Pyrite, Burgess, Ontario, Canada (Cat. No. 84098, U.S.N.M.); hauerite, Mimeo, Catania, Sicily (Cat. No. 51128, U.S.N.M.).

Combination of the cube and octahedron: Galena, Alston Moor, Cumberland, England (Cat. No. 49592, U.S.N.M.).

Combination of the dodecahedron and cube: Cuprite, Chessy, France (Cat. No. 47395, U.S.N.M.); magnetite, Mineville, Essex County, New York (Cat. No. 47830, U.S.N.M.).

Combination of the cube, pentagonal dodecahedron, and octahedron: Pyrite, Texas, Lancaster County, Pennsylvania. (Cat No. 81580, U.S.N.M.)

Combination of the dodecahedron and ikositetrahedron: Garnet, Stickeen River, Alaska. (Cat. No.21209, U.S.N.M.)

Combination of the octahedron, cube, and dodecahedron: Cuprite, Cornwall, England. (Cat. No. 50132, U.S.N.M.)

The tetrahedron: Tetrahedrite, Kapnik, Hungary. (Cat. No. 48653, U.S.N.M.)

Combination of the plus and minus tetrahedrons: Tetrahedrite, Kapnik, Hungary. (Cat. No. 48653, U.S.N.M.)

Combination of the cube, dodecahedron, and the plus and minus tetrahedrons: Boracite, Lunenberg, Germany. (Cat. No. 45679, U.S.N.M.)

The pentagonal dodecahedron: Cobaltite, Tunaberg, Sweden (Cat. No. 49003, U.S.N.M.); pyrite, Saratoga mine, Central, Colorado (Cat. No. 48557, U.S.N.M.).

Combination of the pentagonal dodecahedron, diploid, and octahedron: Pyrite, Kongsberg, Norway. (Cat. No. 13116, U.S.N.M.)

Combination of the diploid, cube, and pentagonal dodecahedron: Pyrite, Brosso, Piedmont, Italy. (Cat. No. 51881, U.S.N.M.)

Tetragonal system.—Lateral axes equal, the vertical a varying axis. Includes all forms referable to one principal, or vertical, axis which is perpendicular to, and different in length from, the lateral axes. The two lateral axes intersect each other and the vertical axis at angles of 90 degrees.

Examples.

The pyramid: Scheelite, Schlackenwald, Bohemia (Cat. No. 84122, U.S.N.M.); octahedrite, Pardatsch, Tavetschthal, Switzerland (Cat. No. 81464, U.S.N.M.).

The prism: Apophyllite, Cape D'Or, Minas Basin, Nova Scotia. (Cat. No. 83416, U.S.N.M.)

Combination of the pyramid, prism, and basal plane: Vesuvianite, Italian Peak, Gunnison County, Colorado. (Cat. No. 82124, U.S.N.M.)

Combination of the pyramid and prism: Thorite, Arendal, Norway (Cat. No. 84130, U.S.N.M.); rutile, Graves Mountain, Lincoln County, Georgia (Cat. No. 84099, U.S.N.M.).

Combination of the prism and pyramid: Zircon, Natural Bridge, Lewis County, New York. (Cat. No. 81654, U.S.N.M.)

Combination of the pyramid and two prisms: Wernerite, Pierrepont, St. Lawrence County, New York. (Cat. No. 14314, U.S.N.M.)

Hexagonal system.—Axes four. The three lateral axes equal, intersecting the principal, or vertical axis, at angles of 90 degrees, and each other at angles of 60 degrees. The vertical axis of a variable length.

Examples.

The pyramid: Quartz, Amelia Courthouse, Virginia (Cat. No. 47958, U.S.N.M.); corundum, Ceylon (Cat. No. 83030, U.S.N.M.).

The prism: Pyromorphite, Little Giant mine, Shoshone County, Idaho (Cat. No. 48590, U.S.N.M.); beryl, Leiper's quarry, Chester, Pennsylvania (Cat. No. 50642, U.S.N.M.).

Combination of the pyramid and prism: Quartz, Warstein, Germany. (Cat. No. 81409, U.S.N.M.)

Combination of the prism and pyramid: Beryl, Stony Point, Alexander County, North Carolina. (Cat. No. 82837, U.S.N.M.)

Combination of the prism, pyramid, and base: Apatite, Renfrew County, Canada. (Cat. No. 82365, U.S.N.M.)

The rhombohedron: Chabazite, Wassons Bluff, Minas Basin, Nova Scotia (Cat. No. 81347, U.S.N.M.); rhodochrosite, John Reed mine, Alicante, Lake County, Colorado (Cat. No. 84128, U.S.N.M.); calcite, England (Cat. No. 83376, U.S.N.M.).

The scalenohedron: Calcite, Oswego Land, Joplin, Missouri. (Cat. No. 81778, U.S.N.M.)

Combination of a rhombohedron and a scalenohedron: Hematite, Elba (Cat. No. 82419, U.S.N.M.); calcite, England. (Cat. No. 83376, U.S.N.M.)

Combination of a scalenohedron and a rhombohedron: Calcite, Joplin, Missouri. (Cat. No. 84100, U.S.N.M.)

Combination of a prism, rhombohedron, and a scalenohedron: Calcite, Bigrigg mine, Egremont, England. (Cat. No. 51228, U.S.N.M.)

Orthorhombic system.—Axes unequal. All forms referable to three axes of unequal length intersecting at angles of 90 degrees.

Examples.

The pyramid: Cerussite, Mies, Bohemia (Cat. No. 84117, U.S.N.M.); sulphur, Truskaniec, Galicia, Hungary (Cat. No. 47270, U.S.N.M.); brookite, Magnet Cove, Arkansas (Cat. No. 81462, U.S.N.M.).

The prism: Andalusite, Swarthmore, Delaware County, Pennsylvania (Cat. No. 81962, U.S.N.M.); staurolite, Lisbon, New Hampshire. (Cat. No. 81901, U.S.N.M.)

Combination of a prism, two domes, and the base: Celestite, Girgenti, Sicily. (Cat. No. 84120, U.S.N.M.)

Combination of a prism, pyramid, and the base: Chalcocite, Redruth, Cornwall, England. (Cat. No. 84119, U.S.N.M.)

Monoclinic system.—Axes unequal. All forms referable to three axes of unequal length. One axial intersection oblique, the other two at angles of 90 degrees.

Examples.

The pyramid: Lazulite, Graves Mountain, Georgia (Cat. No. 45720, U.S.N.M.); tinkal, Fish Lake, Nevada (Cat. No. 7058, U.S.N.M.).

The prism: Adularia, St. Gothard, Switzerland (Cat. No. 81932, U.S.N.M.); titanite, New York (Cat. No. 83201, U.S.N.M.).

Combination of a dome and two prisms: Wolframite, Zinnwald, Saxony. (Cat. No. 84121, U.S.N.M.)

Combination of the base, pinacoid, prism, and dome: Orthoclase, Breckenridge, Colorado. (Cat. No. 13878, U.S.N.M.)

Combination of the prism, pyramid, and two pinacoids: Pyroxene, Diana, Lewis County, New York. (Cat. No. 82496, U.S.N.M.)

Combination of a pinacoid, pyramid, and prism: Gypsum, Ellsworth, Mahoning County, Ohio. (Cat. No. 82561, U.S.N.M.)

Combination of two pinacoids, two pyramids, a prism, and the base: Diopside, Dekalb, New York. (Cat. No. 48296, U.S.N.M.)

Combination of a prism, dome, pinacoid, and base: Heulandite, Beru-fiord, Iceland. (Cat. No. 84157, U.S.N.M.)

Triclinic system.—Axes unequal. All forms referable to three axes of unequal length, and whose axial intersections are all oblique.

Examples.

The prism: Kyanite, Yancey County, North Carolina. (Cat. No. 83520, U.S.N.M.)

Combination of the base, pinacoid, prism, and dome: Albite, Macomb, St. Lawrence County, New York (Cat. No. 81981, U.S.N.M.); oligoclase, Fine, St. Lawrence County, New York. (Cat. No. 48307, U.S.N.M.)

SYMMETRY.

A crystal shows symmetry when it can be revolved about an axis an even multiple of 360 degrees without its position as a whole in space being changed, or can be cut in halves which are to each other as their

mirror reflections. All faces of a crystal are symmetrical about a point, and in some crystals are grouped in accordance with certain definite planes of symmetry: that is, a plane which is capable of dividing the crystal in halves, whose internal and external forms are to each other as a reflection, and also with axes of symmetry. Axes of symmetry may be defined as lines passing through the center of a crystal about which it can be revolved through an angle of 60 degrees (hexagonal axis), 90 degrees (tetragonal axis), 120 degrees (trigonal axis), or 180 degrees (digonal axis), without its position as a whole in space being changed. All crystals may be grouped under seven systems in thirty-two types in accordance with their symmetry, as follows:

Isometric system.—Types: Holohedral, tetrahedral-hemihedral, pentagonal-hemihedral, plagiohedral-hemihedral, and tetartohedral. The most general form possesses nine planes of symmetry, of which three (S planes) are at right angles to one another, and six (Σ planes) which bisect the angles formed by the S planes. There are thirteen axes of symmetry, of which three are tetragonal (□) and are perpendicular to the S planes and parallel to the intersection of two S and two Σ planes; four are trigonal (△) and are parallel to the intersections of three Σ planes; six are digonal (○) and are perpendicular to the Σ planes and parallel to the intersection of an S and Σ plane.

The types are illustrated by models which may be described as follows:

Holohedral type.—The hexoctahedron. Form having four trigonal (△), three tetragonal (□), and six digonal (○) axes, and nine planes of symmetry, three S and six Σ planes.

Tetrahedral-hemihedral type.—The tetrahedron. Form having four trigonal (△) and three digonal (○) axes, with six Σ planes of symmetry.

Pentagonal-hemihedral type.—The pentagonal dodecahedron. Form having four trigonal (△) and three digonal (○) axes, with three S planes of symmetry.

Plagiohedral-hemihedral type.—The pentagonal ikositetrahedron. Form having four trigonal (△), three tetragonal (□), and six digonal (○) axes, with no plane of symmetry.

Tetartohedral type.—The tetrahedron. Form having four trigonal (△) and three digonal (○)axes, with no plane of symmetry.

Hexagonal system.—Types: Holohedral, hemimorphic, pyramidal-hemihedral, trapezohedral-hemihedral, and hemimorphic-hemihedral. The most general form possesses seven planes of symmetry, of which six (S planes) intersect each other at angles of 60 degrees, and one (C plane) which is at right angles to these.

There are seven axes of symmetry, of which one, the hexagonal (⬡) is perpendicular to the C plane and parallel to the intersections of the S planes; six are digonal (○) and lie in the C plane at right angles to the S planes.

The types are illustrated by models which are described as follows:

Holohedral type.—The dihexagonal bipyramid. Form having one hexagonal (⬡) and six digonal (○) axes, with one C and six S planes of symmetry.

Hemimorphic type.—The dihexagonal pyramid. Form having the hexagonal (⬡) axis only, with six S planes of symmetry.

Pyramidal-hemihedral type—The hexagonal bipyramid. Form having the hexagonal (⬡) axis only, with one plane, C, of symmetry.

Trapezohedral-hemihedral type.—The hexagonal trapezohedron. Form having one hexagonal (⬡) axis and six digonal (○) axes, with no plane of symmetry.

Hemimorphic-hemihedral type.—The hexagonal pyramid. Form having the hexagonal (⬡) axis only, with no plane of symmetry.

Trigonal system.—Types: Trigonal-hemihedral, rhombohedral-hemihedral, hemimorphic-hemihedral, trigonal-tetartohedral, trapezohedral-tetartohedral, rhombohedral-tetartohedral, and hemimorphic-tetartohedral. The most complete form possesses four planes of symmetry, of which three (S planes) intersect each other at angles of 120 degrees, and the fourth (C) is at right angles to these.

There are four axes of symmetry, of which one, the trigonal (△) is parallel to the intersections of the S planes and at right angles to the C plane; the other three, the digonal (○) axes, lie in the C plane at right angles to the intersections of the S planes.

The models illustrating the types are described as follows:

Trigonal-hemihedral type.—The ditrigonal bipyramid. Form having the trigonal (△) and three digonal (○) axes, with four planes of symmetry, one C and three S.

Rhombohedral-hemihedral type.—The scalenohedron. Form having the trigonal (△) and three digonal (○) axes, with three S planes of symmetry.

Hemimorphic-hemihedral type.—The ditrigonal pyramid. Form having the trigonal (△) axis, with three S planes of symmetry.

Trigonal-tetartohedral type.—The trigonal bipyramid. Form having the trigonal (△) axis and the plane, S, of symmetry.

Trapezohedral-tetartohedral type.—The trigonal trapezohedron. Form having the trigonal (△) and three digonal (○) axes, with no plane of symmetry.

Rhombohedral-tetartohedral type.—The rhombohedron. Form centro-symmetrical and having the trigonal (△) axis.

Hemimorphic-tetartohedral type.—The trigonal pyramid. Form having the trigonal (△) axis only, and no plane of symmetry.

Tetragonal system.—Types: Holohedral, hemimorphic-hemihedral, pyramidal-hemihedral, trapezohedral-hemihedral, sphenoidal-hemihedral, hemimorphic-tetartohedral, and sphenoidal-tetartohedral. The most general form possesses five planes of symmetry, of which two (S planes) are at right angles to one another, and two (Σ planes) which bisect the angles formed by the S planes; and another plane (C) which is perpendicular to the S and Σ planes.

There are five axes of symmetry, one of which is tetragonal (□) and is perpendicular to the C plane and parallel to the intersections of two S and two Σ planes, and four digonal (○) which lie in the C plane and at right angles to the S and Σ planes.

Examples of the types are described as follows:

Holohedral type.—The ditetragonal bipyramid. Form having one tetragonal (□) axis and four digonal (○) axes, with two S, two Σ, and the C planes of symmetry.

Hemimorphic-hemihedral type.—The ditetragonal pyramid. Form having the tetragonal (□) axis, with two S and two Σ planes of symmetry.

Pyramidal-hemihedral type.—The tetragonal bipyramid. Form having the tetragonal (□) axis only and the C plane of symmetry.

Trapezohedral-hemihedral type.—The tetragonal trapezohedron. Form having the tetragonal (□) and four digonal (○) axes with no plane of symmetry.

Sphenoidal-hemihedral type.—The tetragonal scalenohedron. Form having three digonal (○) axes and two S planes of symmetry.

Hemimorphic-tetartohedral type—The tetragonal pyramid. Form having but one axis, the tetragonal (□), and no plane of symmetry.

Sphenoidal-tetartohedral type.—The tetragonal bisphenoid. Form having but one axis, a digonal (○), and no plane of symmetry.

Orthorhombic system.—Types: Holohedral, hemihedral, and hemimorphic. The most general form possesses three planes of symmetry, of which two (S planes) intersect each other at right angles, and a third (C) is normal to these.

There are three axes of symmetry, all digonal (○), which are perpendicular to the planes of symmetry.

Examples of the types are described as follows:

Holohedral type.—The orthorhombic bipyramid. Form having three digonal (○) axes with one C and two S planes of symmetry.

Hemihedral type.—The orthorhombic bisphenoid. Form having three digonal (○) axes and no plane of symmetry.

Hemimorphic type.—The orthorhombic pyramid. Form having one digonal (○) axis and no plane of symmetry.

Monoclinic system.—Types: Holohedral, hemimorphic, and hemihedral. The most general form possesses one plane (S) of symmetry and one digonal (○) axis, which is perpendicular to the plane of symmetry.

Examples of the types are described as follows:

Holohedral type.—The monoclinic pyramid. Form having one digonal (○) axis and one S plane of symmetry.

Hemimorphic type.—The monoclinic sphenoid. Form having the digonal (○) axis but no plane of symmetry.

Hemihedral type.—The monoclinic dome. Form having an S plane of symmetry, but no axis of symmetry.

Triclinic system. Types: Holohedral and hemihedral. The most general form possesses centrosymmetry only, and has no plane or axis of symmetry.

Examples of the types are described as follows:

Holohedral type.—The triclinic pyramid. Form centrosymmetrical, but without either plane or axis of symmetry.

Hemihedral type.—The pedion. The form is completely unsymmetrical.

COMPOUND CRYSTALS.

Compound crystals are divided into two classes, according as the several individuals are in reversed or parallel positions with reference to each other; that is, into twin crystals and parallel growths.

Twin crystals are those in which one or more parts, regularly arranged, are in a reversed relation to the other part or parts. A twin crystal may be conceived of as two individuals, or parts of the same individual placed in a parallel position, and then a half revolution to

take place about a certain axis which will bring them into a reversed or twinning position.

Twin crystals are classed as contact twins and penetration twins.

Parallel growths are those in which the molecular arrangement is completely parallel in the component individuals; that is, the corresponding planes are parallel throughout all the individuals, and they are only separated from each other by their external planes.

The following are illustrations of the methods of twinning and of parallel growths:

Penetration twin: Fluorite, Cumberland, England. (Cat. No. 49946, U.S.N.M.)

Contact twin: Calcite, Woodcock mine, Granby, Missouri. (Cat. No. 81254, U.S.N.M.)

Carlsbad twin: Orthoclase, near Leadville, Colorado. (Cat. No. 45179, U.S.N.M.)

Baveno twin: Orthoclase, Baveno, Lombardy, Italy. (Cat. No. 82410, U.S.N.M.)

Mannebacher twin: Orthoclase, Tanagama-Yama, Japan. (Cat. No. 51147, U.S.N.M.)

Metagenic twin: Rutile, Magnet Cove, Arkansas. (Cat. No. 51723, U.S.N.M.)

Paragenic twin: Fluorite, Cumberland, England. (Cat. No. 49946, U.S.N.M.)

Geniculated twin: Rutile, Christiana, Lancaster County, Pennsylvania. (Cat. No. 81905, U.S.N.M.)

Trilling: Staurolite, Morganton, Fannin County, Georgia (Cat. 48029, U.S.N.M.).

Fourling: Staurolite, Morganton, Fannin County, Georgia (Cat. No. 48030, U.S.N.M.)

Contact twins: Cassiterite, Schlagenwald, Bohemia (Cat. No. 82083, U.S.N.M.); Calcite, Guanajuato, Mexico (Cat. No. 50077, U.S.N.M.); Aragonite, Herrengrund, Hungary (Cat. No. 82241, U.S.N.M.); Gypsum, Racamulto, Sicily (Cat. No. 51743, U.S.N.M.).

Penetration twins: Pyrite, Tavistock, Devonshire, England (Cat. No. 82054, U.S.N.M.); Quartz, Warstein, Germany (Cat. No. 82014, U.S.N.M.); Staurolite, Fannin County, Georgia (Cat. No. 82573, U.S.N.M.); Harmotome, Strontian, Argylshire, Scotland (Cat. No. 48730, U.S.N.M.); Microcline, Pikes Peak, Colorado (Cat. No. 48564, U.S.N.M.).

Parallel growths: Quartz, Rauris, Salsburg, Austria (Cat. No. 51831, U.S.N.M.); Hematite, Elba (Cat. No. 3315, U.S.N.M.); Adularia coated with chlorite, Viesch, Switzerland (Cat. No. 51295, U.S.N.M.); Albite, Topsham, Maine (Cat. No. 83488, U.S.N.M.); Witherite, Cumberland, England (Cat. No. 84116, U.S.N.M.); Calcite, Guanajuato, Mexico (Cat. No. 50087, U.S.N.M.); Pyrite, French Creek, Chester County, Pennsylvania (Cat. No. 83608, U.S.N.M.).

IMPERFECTIONS OF CRYSTALS.

A crystal is theoretically a symmetrical polyhedron having its homologous faces, angles, and dimensions in the direction of like axes equal. This ideal condition is rarely attained by the crystal; the form may be distorted, the planes may be irregular, or the crystal may contain internal impurities.

The crystal, then, may fall short of perfection by distortion of form, imperfection of crystal planes, internal impurities.

Examples:

Distortion of form, due to a curvature of dynamic origin: Galena, Joplin, Missouri (Cat. No. 81766, U.S.N.M.); Gypsum, Friedrichrode, Thuringia (Cat. No. 82413, U.S.N.M.); Quartz, Crystal Mountain, Hot Springs, Arkansas (Cat. No. 45208, U.S.N.M.); Zircon in Wollastonite, Natural Bridge, Lewis County, New York (Cat.

No. 49698, U.S.N.M.); Pyrite, Sherwood, Jasper County, Missouri (Cat. No. 51311, U.S.N.M.).

Irregularity of planes, due to unequal rapidity of growth: Beryl, Oxford County, Maine. (Cat. No. 46125, U.S.N.M.)

Imperfection of planes, due to striation: Rutile, Parkesburg, Pennsylvania (Cat. No. 49649, U.S.N.M.); Beryl, Adun-Chalon, Nertschinsk, Siberia (Cat. No. 16246, U.S.N.M.).

Irregularity of planes, due to polysynthetic twinning: Rutile, Parkesburg, Pennsylvania. (Cat. No. 49649, U.S.N.M.)

Irregularity of planes, curvature due to irregularity of growth: Dolomite, Oswego land, Joplin, Missouri. (Cat. No. 82120, U.S.N.M.)

Irregularity of planes, curvature due to oscillatory combination: Calcite, Joplin, Missouri (Cat. No. 82160, U.S.N.M.); Smoky Quartz, St. Gothard, Switzerland (Cat. No. 82358, U.S.N.M.).

Irregularity of planes, the result of corrosion: Galena, Joplin, Missouri (Cat. No. 51225, U.S.N.M.); Franklinite, Franklin, Sussex County, New Jersey (Cat. No. 83941, U.S.N.M.).

Internal impurity: Andalusite inclosing carbonaceous matter, Lancaster, Massachusetts (Cat. No. 82667, U.S.N.M.); tourmaline inclosing orthoclase, Crown Point, New York (Cat. No. 18380, U.S.N.M.); quartz inclosing sand, Edwards, St. Lawrence County, New York (Cat. No. 48286, U.S.N.M.); quartz inclosing mud, Burke County, North Carolina (Cat. No. 82916, U.S.N.M.); calcite inclosing sand (Fontainebleau limestone), Fontainebleau, France (Cat. No. 49286, U.S.N.M.).

PLEOMORPHISM.

Pleomorphism is that tendency of some chemical compounds to crystallize in two or more distinct forms. Specimens of the following compounds illustrate this tendency:

Calcium carbonate, $CaCO_3$, crystallizes in the rhombohedral system as calcite, in the orthorhombic system as aragonite.

Titanium dioxide, TiO_2, crystallizes in the tetragonal system as rutile and octahedrite, in the orthorhombic system as brookite.

Iron bisulphide, FeS_2, crystallizes in the isometric system as pyrite, in the orthorhombic system as marcasite.

ISOMORPHISM.

Isomorphism has been defined by Mitscherlich, its discoverer, as "substances which are analogous chemical compounds have the same, or nearly the same crystalline form." That is, two more distinct chemical compounds may crystallize in like forms. Examples of this tendency are shown in—

Spinel, $MgAl_2O_4$, Magnetite, $FeFe_2O_4$, franklinite, $(FeZnMn)(FeMn)_2O_4$. Crystals isometric, commonly octahedral.

Rutile, TiO_2, Cassiterite, SnO_2. Crystals tetragonal, commonly prismatic.

Apatite, $(CaF)Ca_4(PO_4)_3$, pyromorphite, $(PbCl)Pb_4(PO_4)_3$, mimetite, $(PbCl)Pb_4(PO_4)_3$, vanadinite, $(PbC)Pb_4(VO_4)_3$. Crystals hexagonal with pyramidal hemihedrism.

Barite, $BaSO_4$. Celestite $SrSO_4$, anglesite, $PbSO_4$. Crystals orthorhombic, commonly tabular.

PSEUDOMORPHS.

Pseudomorph is that term applied to certain crystals or forms which have the angles and general habits of a certain mineral with the composition and, in some instances, the structure of another; that is, the

original substance has been changed to a new compound, or has disappeared and been replaced by another to which the habit of crystallization or structure presented does not belong. Pseudomorphs are of three kinds: Substitution, deposition, and alteration.

Pseudomorphs by substitution comprise those cases in which there has been a more or less gradual replacement of the original material by another without chemical action taking place, and the form and structure of the original substance is preserved.

Examples.

Quartz, SiO_2, after fluorite, CaF_2, Cornwall, England (Cat. No. 82106, U.S.N.M.); cassiterite, SnO_2, after orthoclase, $KAlSi_3O_8$, Cornwall, England (Cat. No. 13431, U.S.N.M.); Copper, Cu, after aragonite, $CaCO_3$, Corocoro, Bolivia (Cat. No. 10579, U.S.N.M.).

Pseudomorphs by deposition fall under two heads: Incrustation, in which a layer or crust of a mineral deposited upon the surface of another substance assumes the form of that substance in a more or less perfect manner; infiltration, in which case a cavity or mold made by the removal of a substance has been filled by the deposition of a mineral.

Examples.

By incrustation: Quartz, SiO_2, after calcite, $CaCO_3$, Schneeberg, Saxony (Cat. No. 45640, U.S.N.M.); calcareous-tufa, $CaCO_3$, after leaves, organic, Bear Spring, Beaver Head Canyon, Montana (Cat. No. 18648, U.S.N.M.).

By infiltration: Flint, SiO_2, after echinus, organic, Gravesend, England (Cat. No. 82465, U.S.N.M.); silica, SiO_2, after wood, organic, Greenwich, New Jersey (Cat. No. 81879, U.S.N.M.).

Pseudomorphs by alteration include those cases in which there has been a partial change of composition or structure and the secondary mineral retains some of the constituents of the first. This alteration may take place. First, through paramorphism, or molecular rearrangement. Second, by the loss or assumption, or both, of an ingredient. Third, by a partial exchange of constituents.

Examples.

Paramorphs: Aragonite, $CaCO_3$, after calcite, $CaCO_3$, Girgenti, Sicily (Cat. No. 46527, U.S.N.M.); rutile, TiO_2, after brookite, TiO_2, Magnet Cove, Arkansas. (Cat. No. 50048, U.S.N.M.)

Loss: Copper, Cu, after azurite, $Cu_3(OH)_2(CO_3)_2$, Copper Glance and Potosi mines, Grant County, New Mexico. (Cat. No. 48678, U.S.N.M.) Azurite, $Cu_3(OH)_2(CO_3)_2$, altering to malachite, $Cu_2(OH)_2CO_3$, Copper Queen mine, Bisbee, Arizona. (Cat. No. 48127, U.S.N.M.)

Assumption: Malachite, $Cu_2(OH)_2CO_3$, after cuprite, Cu_2O, Chessy, France. (Cat. No. 82086, U.S.N.M.)

Loss and assumption: Galena, PbS, after pyromorphite $(PbCl)Pb_4(PO_4)_3$, Bernkastle, Prussia. (Cat. No. 46173, U.S.N.M.)

Exchange of constituents: Chlorite $(Fe,Mg)_5$ $(Al,Fe)_2$ Si_4O_{19}. $3H_2O$ after garnet, $(Fe,Ca,Mg,Mn)_3Al_2Si_3O_{12}$, Salida, Chaffee County, Colorado. (Cat. No. 81216, U.S.N.M.)

CRYSTALLINE AGGREGATES.

Many specimens of minerals occur in aggregates of imperfect crystals: accordingly the remaining kinds of structure may be brought together under the head of crystalline aggregates.

The individuals composing imperfectly crystalline masses may be: In columns or fibers, in which case the structure is columnar; in thin laminæ, plates, or leaves, giving rise to a lamellar structure; in grains, producing a granular structure. Further, there are numerous irregular and accidental groupings of the individuals composing the mass, giving to it certain shapes, such as globular, botryoidal, reniform, dendritic, etc., which are too numerous to allow of a specification here. These indeterminate forms are grouped under the head of "imitative shapes." Finally, the mass may be entirely destitute of crystalline structure or imitative shape. Such a mass is called amorphous.

Examples of Structure.

Columnar.—Kylindrite, Poopo, Bolivia. (Cat. No. 84156, U.S.N.M.)

Fibrous.—Asbestus, Corsica. (Cat. No. 82259, U.S.N.M.)

Stellate.—Stilbite, Wassons Bluff, Nova Scotia. (Cat. No. 83407, U.S.N.M.)

Radiated.—Tourmaline in lepidolite, San Diego, California. (Cat. No. 83434, U.S.N.M.)

Lamellar.—Glaucophane, Camp de Praz, Aosta, Piedmont. (Cat. No. 84124, U.S.N.M.)

Straight lamellar.—Wollastonite, Natural Bridge, Lewis County, New York. (Cat. No. 49698, U.S.N.M.)

Lamellar foliated.—Talc, St. Lawrence County, New York. (Cat. No. 44867, U.S.N.M.)

Lamellar micaceous.—Margarite on emery, Chester, Massachusetts. (Cat. No. 13100, U.S.N.M.)

Phenocrystalline.—Chrysolite, Webster, Jackson County, North Carolina. (Cat. No. 48521, U.S.N.M.)

Cryptocrystalline.—Willemite Frankline, Sussex County, New Jersey. (Cat. No. 83615, U.S.N.M.)

Amorphous.—Opal, Douglas County, Washington. (Cat. No. 83447, U.S.N.M.)

Examples of imitative shape.

Botryoidal.—Cacholong, Lölling, Carinthia. (Cat. No. 82067, U.S.N.M.)

Mammillary.—Malachite, Australia. (Cat. No. 82076, U.S.N.M.)

Globular.—Psilomelane. Freiberg, Saxony. (Cat. No. 46016, U.S.N.M.)

Coralloidal.—Aragonite, Dubuque, Iowa. (Cat. No. 82368, U.S.N.M.)

Arborescent.—Copper, Copper Falls, Michigan. (Cat. No. 12061, U.S.N.M.)

Dendritic.—Manganese dendrite, Gallatin County, Montana. (Cat. No. 46950, U.S.N.M.)

Reticulated.—Chalcopyrite, Bristol, Connecticut. (Cat. No. 13162, U.S.N.M.)

Stalactitic.—Calcite, Kutztown, Pennsylvania. (Cat. No. 43126, U.S.N.M.)

Capillary.—Millerite in calcite, Cement quarry, Milwaukee, Wisconsin. (Cat. No. 45838, U.S.N.M.)

Drusy.—Quartz on chalcedony, California. (Cat. No. 17006, U.S.N.M.)

B—CHARACTERS RELATING TO COHESION AND ELASTICITY.

CLEAVAGE.

This is that tendency of a mineral to break in the direction of minimum cohesion, and that direction is always parallel to some plane which occurs or may occur in the crystal. The cleavage is characterized first, according to direction that is, when parallel to certain faces or planes, as cubic, octahedral, dodecahedral, rhombohedral, and also basic, prismatic, macrodiagonal, brachydiagonal, and so on; second, according to the ease with which it may be obtained, as perfect, imperfect, interrupted, or difficult.

Examples of Cleavage.

Cubic.—Galena, Desloge mine, Missouri. (Cat. No. 17213, U.S.N.M.)
Octahedral.—Fluorite, Muscalonge Lake, New York. (Cat. No. 44864, U.S.N.M.)
Dodecahedral.—Sphalerite, Picos del Europa, Spain. (Cat. No. 17699, U.S.N.M.)
Rhombohedral.—Calcite, Chester County, Pennsylvania. (Cat. No. 46496, U.S.N.M.)
Prismatic.—Diopside, Achmatofsk, Siberia. (Cat. No. 49237, U.S.N.M.)
Brachydiagonal.—Diaspore, Chester, Massachusetts. (Cat. No. 47367, U.S.N.M.)
Macrodiagonal.—Kyanite, Litchfield, Connecticut. (Cat. No. 49728, U.S.N.M.)
Clinodiagonal.—Orthoclase, Way's quarry, Newcastle County, Delaware. (Cat. No. 49703, U.S.N.M.)
Basal.—Topaz, Takayama, Japan. (Cat. No. 47119, U.S.N.M.)
Eminent.—Muscovite, Chester County, Pennsylvania. (Cat. No. 83178, U.S.N.M.)
Perfect.—Labradorite, Isle of Paul, Labrador. (Cat. No. 83605, U.S.N.M.)
Distinct.—Pyrite, Leadville, Colorado. (Cat. No. 81847, U.S.N.M.)
Interrupted.—Hypersthene, Franklin, New Jersey. (Cat. No. 83617, U.S.N.M.)
Difficult.—Quartz, Brazil. (Cat. No. 44686, U.S.N.M.)

GLIDING, PRESSURE, AND SEPARATION PLANES.

When a crystal is subjected to pressure in certain directions a new series of planes may be developed, as follows: Gliding planes, the surfaces along which there has been a slipping accompanied by a rotation of the molecules. Pressure planes or percussion figures, the divisional planes diverging from a point of pressure which is applied at right angles to a natural face. Separation planes, false cleavages parallel to possible faces, and which result from the deposition of an impurity on these faces during the growth of the crystal. Examples of these are shown in the specimens of calcite, galena, mica, and quartz.

FRACTURE.

This is that surface obtained by breaking the mineral in a direction other than that of the cleavage. It may be designated as conchoidal, that is, breaking with concavities more or less deep; even, when the fracture approximates a plane surface; uneven, when the surface is irregular; hackly or splintery, when the surface is jagged.

Examples of fracture.

Conchoidal.—Novaculite, Magnet Cove, Arkansas. (Cat. No. 46280, U.S.N.M.)
Even.—Chlorite, Loudon County, Virginia. (Cat. No. 12352, U.S.N.M.)
Uneven.—Lepidolite, Auburn, Maine. (Cat. No. 16157, U.S.N.M.)
Hackly.—Hematite, Dun Mountain, New Zealand. (Cat. No. 17792, U.S.N.M.)

HARDNESS.

This is the degree of resistance a mineral offers to abrasion. It is usually referred to an arbitrary scale of ten minerals showing a regular gradation in hardness from 1, talc, the softest; 2, gypsum; 3, calcite; 4, fluorite; 5, apatite; 6, orthoclase; 7, quartz; 8, topaz; 9, corundum, to 10, diamond, the hardest.

TENACITY.

The degrees of tenacity may be classed as brittle, sectile, malleable, flexible, and elastic.

Examples of these are found in the following specimens:

Calcite, Oxbow, New York (Cat. No. 16883, U.S.N.M.), brittle; the mineral separates in grains or a powder on attempting to cut it with a knife.

Selenite, Truckee Mountains, Nevada (Cat. No. 18374, U.S.N.M.), sectile; the mineral may be cut without falling to pieces, but pulverizes under the hammer.

Copper, Copper Falls, Michigan (Cat. No. 12061, U.S.N.M.), malleable; slices may be cut off and flattened out under the hammer.

Talc, Chester County, Pennsylvania (Cat. No. 12002, U.S.N.M.), flexible; the mineral will bend, but remains bent after the bending force is removed.

Muscovite, Pennsbury, Pennsylvania (Cat. No. 83483, U.S.N.M.), elastic; the mineral after bending will spring back to its original position.

C—CHARACTERS DEPENDING UPON MASS OR VOLUME.

SPECIFIC GRAVITY.

This is the density of the mineral compared with that of distilled water at 4° C. The wide range in the specific gravity of minerals is shown by a series of specimens, and their relative densities shown by cubes, taking a definite volume of water as unity.

D—PROPERTIES RELATING TO HEAT, MAGNETISM, AND ELECTRICITY.

HEAT.

Under this head is included the expansion of minerals, their power of conducting, transmitting, or absorbing heat, and their fusibility. Of these properties fusibility is the most important, and the only one that can be readily illustrated. This property in mineralogy is a relative value, determined by comparison with a fixed scale, showing a regular gradation from 1, stibnite, the most readily fused; 2, natrolite; 3, garnet; 4, actinolite; 5, orthoclase, to 6, bronzite, the most difficult.

MAGNETISM.

All minerals are either magnetic or nonmagnetic. Magnetic minerals may be either paramagnetic, that is, attracted by the poles of a

magnet, or diamagnetic, that is, repelled by the poles of a magnet. These characters can be illustrated properly only in the laboratory, and only those minerals possessing polarity, that is, being themselves magnetic, or those that are sensibly affected by an ordinary magnet, can be shown.

ELECTRICITY.

The electrical properties of minerals are distinguished by the following terms: Frictional electricity, or the power of becoming electrified by friction. Pyroelectricity, or the development of electricity through change of temperature. Thermoelectricity, due to differences of temperature at the point of contact with another substance, and is the electro-motive force developed when two or more minerals which are at different temperatures are brought in contact and establish an electric circuit.

E—CHARACTERS DEPENDING UPON THE ACTION OF LIGHT.

LIGHT.

Light is the sensation produced upon the eye resulting from the excitation of a vibratory motion by a luminous body in the particles of a highly elastic imponderable medium called ether, which is assumed to pervade all space, including the most minute pores of all matter, whether solid, liquid, or gaseous. These vibrations are propagated in straight lines and in all directions from the luminous point. The smallest portion of light which can be separated is called a ray, and it may be considered as a combination of two vibrating motions, one of which for the sake of convenience may be regarded as vertical and the other horizontal. A ray of light will pass through any medium of the same density in a perfectly straight line, but if it pass out of that medium into another of different density it may be disposed of in different ways, being either transmitted, absorbed, reflected, refracted, or polarized.

TRANSMISSION OF LIGHT.

Diaphaneity.—All bodies transmit light to a greater or less degree. Among minerals the amount of light transmitted, or the degrees of transparency, are classed as:

Transparent—when the outline of an object seen through the mineral is perfectly distinct. Subtransparent—when an object may be seen but its outline is indistinct. Translucent—when light is transmitted but objects are not seen. Subtranslucent—when merely the edges are translucent. Opaque—when no light is transmitted. The property of diaphaneity occurs in every degree among minerals and is here represented in its several shades by five specimens of quartz.

ABSORPTION OF LIGHT.

Color.—The color of a mineral depends upon its power of absorbing certain portions of light; that is, absorbing certain rays of the spec-

trum that pass through or fall upon its surface. A yellow mineral, for example, will absorb all the rays of the spectrum except the yellow; a green mineral will reflect chiefly green rays, while a white mineral will reflect all, and a black mineral will absorb all the rays. The color, then, is the result of the mixture of those rays of light which are not absorbed. The color of a mineral is of two kinds—essential and nonessential.

Essential color.—The essential color is that of the mineral itself in its purest state, and belongs not only to the mass, but to the finest particle that can be mechanically divided. The essential color is determined by the color of the fine powder of the mineral, or by rubbing it on a surface of unglazed porcelain. The color of this powder or mark is known as the streak. This character is illustrated by a series of twenty-two minerals. To the left of each specimen is a small vial containing the powder of the mineral. It will be observed that although in many cases the essential color and that of the mineral are the same, in others the color of the streak differs from that of the mass.

Nonessential color.—The nonessential color is in general that of the impurities contained in the mineral and the color of the mass will differ from that of the streak: that is, the same mineral species may display several different colors, all of which disappear in powder.

This nonessential character of the color is seen in specimens of quartz and fluorite, in which the several distinct colors of the individual masses all disappear in the powder.

Varieties of color.—The variations in color are classed, first, as metallic and nonmetallic, and all shades are referred to eight fundamental colors: white, gray, black, blue, green, yellow, red, and brown. Second, according to peculiarities in the arrangement of colors, as play of color, opalescence, iridescence, tarnish, and asterism. Third, as to the difference in color shown for light transmitted in different directions through the crystal. This case of color absorption is called pleochroism and is peculiar to doubly-refracting minerals. Further, certain minerals when viewed under given conditions present a bluish appearance, resulting from the absorption of certain rays of light. This property is called fluorescence.

The principal metallic colors are shown in the following series of minerals. These are:

Copper red: Native copper, Longfellow Mine, Clifton, Arizona (Cat. No. 83558, U.S.N.M.).

Bronze yellow: Pyrrhotite, Småland, Sweden (Cat. No. 46593, U.S.N.M.).

Brass yellow: Chalcopyrite, Shimotcuke Province, Japan (Cat. No. 47154, U.S.N.M.).

Gold yellow: Gold, Nova Scotia (Cat. No. 82217, U.S.N.M.).

Silver white: Silver, Chile (Cat. No. 11994, U.S.N.M.); collected by J. M. Gilliss.

Tin white: Arsenopyrite, Criklova, Banat, Hungary (Cat. No. 48672, U. S. N.M.).

Lead gray: Molybdenite, Altenberg, Saxony (Cat. No. 8129, U.S.N.M.); collected by F. M. Endlich.

Steel gray: Smaltite, Schneeberg, Saxony (Cat. No. 45691, U.S.N.M.).

The principal nonmetallic colors are illustrated by the next forty specimens. They are:

Snow white: Calcite, Copper Queen Mine, Bisbee, Arizona (Cat. No. 82364, U.S.N.M.).

Gray white: Quartz, Cumberland, England (Cat. No. 50502, U.S.N.M.).

Milk white: Novaculite, Montgomery County, Arkansas (Cat. No. 46280, U.S.N.M.).

Ash gray: Opal, Honduras (Cat. No. 49632, U.S.N.M.).

Smoke gray: Flint, Lains, Jura, France (Cat. No. 46367, U.S.N.M.).

Gray black: Basanite, Wyoming (Cat. No. 41731, U.S.N.M.); collected by F. V. Hayden.

Jet black: Tourmaline, Pierrepont, St. Lawrence County, New York (Cat. No. 48279, U.S.N.M.).

Blue: Azurite, Clifton, Arizona (Cat. No. 82543, U.S.N.M.).

Amethyst blue: Amethyst, Thunder Bay, Lake Superior (Cat. No. 49628, U.S.N.M.); the Lea collection.

Sky blue: Smithsonite, Laurium, Greece (Cat. No. 48945, U.S.N.M.).

Mountain blue: Barite, Frizington, Cumberland, England (Cat. No. 84144, U.S.N.M.).

Smalt blue: Dumortierite, Clip, Yuma County, Arizona (Cat. No. 48782, U.S.N.M.).

Verdigris green: Microcline, Pikes Peak, Colorado (Cat. No. 81993, U.S.N.M.).

Emerald green: Malachite, Nizhnee-Taghilsk, Russia (Cat. No. 49401, U.S.N.M.); gift of Mrs. Mary Stroud.

Mountain green: Beryl, Yancey County, North Carolina (Cat. No. 51220, U.S.N.M.).

Lemon yellow: Sulphur, Cianciana, Sicily (Cat. No. 50082, U.S.N.M.).

Orange yellow: Smithsonite, Morning Star mine, Marion County, Arkansas (Cat. No. 48390, U.S.N.M.).

Wine yellow: Topaz, Brazil (Cat. No. 44499, U.S.N.M.).

Wax yellow: Selen sulphur, Cianciana, Sicily (Cat. No. 84140, U.S.N.M.).

Honey yellow: Calcite, Joplin, Missouri (Cat. No. 84165, U.S.N M.).

Scarlet: Vanadinite, Romaldo Pacheco's mine, Yuma County, Arizona (Cat. No. 48793, U.S.N.M.); collected by W. F. Hillebrand.

Blood red: Zincite, Franklin, New Jersey (Cat. No. 83618, U.S.N.M.); collected by Wirt Tassin.

Rose red: Tourmaline in lepidolite, San Diego, California (Cat. No. 83431, U.S.N.M.); gift of Henry S. Durdan.

Rose pink: Calcsinter, Reichelsdorf, Hessen, Germany (Cat. No. 84055, U.S.N.M.).

Brown: Tourmaline, Gouverneur, St. Lawrence County, New York (Cat. No. 82279, U.S.N.M.).

Yellow brown: Jasper, Portage Group, New York (Cat. No. 49631, U.S.N.M.); the Lea collection.

Hair brown: Wood Opal, California (Cat. No. 81883, U.S.N.M.).

The peculiarities in the arrangement of colors are shown in the following specimens. They are as follows:

Play of color: Opal, Queretaro, Mexico (Cat. No. 45014, U.S.N.M.); opal in limonite, Baracoo River, Queensland, Australia (Cat. No. 51965, U.S.N.M.).

Change of color: Labradorite, Isle of Paul, Labrador (Cat. No. 83605, U.S.N.M.); oligoclase, Krageröe, Norway (Cat. No. 45094, U.S.N.M.).

Opalescence: Quartz with tremolite inclusions, Ceylon (Cat. No. 81405, U.S.N.M.); opal, Queretaro, Mexico (Cat. No. 81283, U.S.N.M.).

Iridescence: Albite, Amelia Court-House, Amelia County, Virginia (Cat. No. 48724, U.S.N.M.); oligoclase, Krageröe, Norway (Cat. No. 44776, U.S.N.M.).

Tarnish: Chalcopyrite with quartz, Cornwall, England (Cat. No. 16987, U.S.N.M.), the Abert collection; bornite, South Africa (Cat. No. 51882, U.S.N.M.).

Asterism: Corundum, Ceylon (Cat. No. 82892, U.S.N.M.).

Pleochroism: Iolite, Haddam, Connecticut (Cat. No. 83616, U.S.N.M.).

Fluorescence: Fluorite, England (Cat. No. 49492, U.S.N.M.).

EMISSION OF LIGHT—PHOSPHORESCENCE.

Phosphorescence, or the emission of light, may be produced in different ways—by rise of temperature, by mechanical effects (such as friction, percussion, or cleavage) and by insolation—that is, by exposure to the direct action of sunlight.

Phosphorescence by rise of temperature is best seen in fluorite (Cat. No. 49598, U.S.N.M.), when heated to 145° or 150°, and especially in the variety chlorophane.

Phosphorescence by friction will result from rubbing the specimen of sphalerite (Cat. No. 12562, U.S.N.M.) in the dark.

Phosphorescence by insolation is seen in some diamonds, such as the specimen shown, and in some varieties of fluorite, such as chlorophane.

REFLECTION OF LIGHT.

When a ray of light passes from one medium to another, a portion of it is always thrown back or reflected. Every substance in nature possesses in a greater or less degree the power of reflecting the light rays which fall upon it. The amount of light reflected depends mainly upon the condition of the surface of the substance.

Luster.—Among minerals luster is that character depending upon the power and manner of reflecting light, and is dependent upon the nature of the reflecting surface and the quantity or intensity of the light reflected. The kinds of luster are: Metallic, submetallic, adamantine, vitreous, resinous, pearly, and silky. The degrees of intensity are: Splendent, shining, glistening, glimmering, and dull.

The specimens showing the different kinds and degrees of luster are:

Metallic: Galena, Hermosa, New Mexico (Cat. No. 48173, U. S.N.M.); collected by W. F. Hillebrand.

Adamantine: Cerussite, county Yancowinna, New South Wales (Cat. No. 82480, U.S.N.M.).

Vitreous: Quartz, Eldorado County, California (Cat. No. 16052, U.S.N.M.).

Resinous: Sphalerite, Cartagena, Murcia, Spain (Cat. No. 18309, U.S.N.M.).

Pearly: Brucite, Texas, Lancaster County, Pennsylvania (Cat. No. 81884, U.S.N.M.); the U. S. Geological Survey.

Silky: Selenite, England (Cat. No. 16786, U.S.N.M.).

Splendent: Hematite, Isle of Elba (Cat. No. 49971, U.S.N.M.); the Lea Collection.

Shining: Celestite, Girgenti, Sicily (Cat. No. 49789, U.S.N.M.); the Lea Collection.

Glistening: Talc, Edwards, St. Lawrence County, New York (Cat. No. 48227, U.S.N.M.); collected by S. L. Penfield.

Glimmering: Chalcedony, Faroe Islands (Cat. No. 82224, U.S.N.M.).

Dull: Kaolin, Berks County, Pennsylvania (Cat. No. 9783, U.S.N.M.).

REFRACTION OF LIGHT.

A ray of light passing from one medium to another which is of different density, and in a direction other than that of a perpendicular to

the surface of the second medium, changes its direction or is refracted. When light passes from a rarer to a denser medium, it is refracted toward the perpendicular; if from a denser to a rarer medium, it is refracted away from the perpendicular.

These conditions are universally true, and may be summarized as follows: When light passes from a denser to a rarer medium, the angle of incidence is less than the angle of refraction. When light passes out of a rarer into a denser medium, the angle of incidence is greater than the angle of refraction. The ratio existing between the sines of the angles of incidence and refraction is called the index of refraction. This is constant for the same substance.

The above assumes the existence of only one refracted ray; but there are sometimes two refracted rays, whence it follows that an object seen through such a medium appears double. Crystals which possess this peculiarity are said to be double refracting. It is possessed to a greater or less degree by all crystals which belong to systems of crystallization other than the isometric.

Uniaxial and biaxial crystals.—In all double-refracting crystals there is one direction, and sometimes a second, possessing the following property: When a point is looked at through the crystal in such a direction, it does not appear double. The lines fixing these directions are called optic axes.

A crystal is uniaxial when it has one optic axis; that is, when there is but one direction along which a ray of light can pass without being doubly refracted. A crystal having two such axes is called biaxial. Further, of the two parts into which the incident ray is divided on entering a uniaxial crystal, one is called the ordinary and the other the extraordinary ray. The one follows the law of single refraction; the other, except under certain conditions, does not. The magnitude of the refractive indices of these two rays always differ for the same crystal, and should that of the ordinary ray exceed that of the extraordinary ray the crystal is negative uniaxial; should the contrary be the case the crystal is positive uniaxial.

DIFFRACTION OF LIGHT.

If a beam of light be made to pass through a narrow slit and by the edge of an opaque body and to fall upon an appropriately placed screen, the shadow of such a body will be divided into a series of light and dark parallel bands, and the rays are diffracted. These bands or fringes are due to the mutual reaction or interference of the adjoining waves of light. Models 1 and 2 are of waves of light. The third model shows the waves of 1 and 2 neutralized by superposition and interference of two equal systems, the raised part of one wave fitting into and making smooth the hollow of the other. The next figure represents the solar spectrum, showing the dark lines, called Fraunhofer's lines, which

are the result of interference. The last model shows the effect of interference in monochromatic or homogeneous light. With common light the prismatic colors are shown in succession.

POLARIZATION OF LIGHT.

"Polarization is, in general, that change in the character of reflected or transmitted light which diminishes its power of being further reflected or transmitted." To follow up the mechanical notion of the nature of polarized light it is necessary to refer to the wave model of common light, and by separating the two parts one from the other it may be shown how a wave of common light is reducible to two primary waves whose vibrations take place in a single plane only, or are polarized.

Light may be polarized by reflection and simple refraction, double refraction, and absorption. The first model shows a mechanical conception of a ray of common light made up of the transversal vibrations A and B. The second model is a wire bent to represent a horizontal vibration which, if kept in that position, will pass only through a horizontal aperture; the third model is a wire bent to represent a perpendicular vibration which will pass only through a perpendicular aperture. The next model illustrates polarization by means of reflection and single refraction; A-A is a model of a bundle of glass plates placed at an angle of 56° 45′; B is a ray of common light; C shows the light polarized by reflection and D by refraction.

Polarization by double refraction is shown by a glass model representing a rhomb of calcite. A ray of light, A, entering the rhomb is doubly refracted, or divided into two rays of polarized light. One of these rays, O, conforms with the law of ordinary refraction, and is called the ordinary ray; the other does not conform with the law, and is called the extraordinary ray E.

Polarization by absorption is shown by the next model, in which a slice of tourmaline is regarded, mechanically, as being like a grating through which polarized light may pass, then A is the model of a slice of tourmaline into which the transversal vibrations, B, are passing; the horizontal wave is absorbed and the vertical polarized one passes to the second slice of tourmaline, C, where the bars (the axes) being at right angles to those of A, it is stopped, and can pass through only when the bars of C are parallel to those of A.

INTERFERENCE FIGURES.

If a section of a doubly refracting mineral, which is cut perpendicular to an optic axis, be examined in polarized light it will exhibit, under certain conditions, colored rings or bands. According to the undulatory theory of light these rings arise from the interference of the waves of the ordinary and extraordinary rays.

The observation of the systems of rings, or interference figures, which thin plates of crystals give in polarized light affords a ready means of

determining the system in which a mineral crystallizes. All minerals may be classed as either isotropic or anisotropic with reference to their behavior in light. Anisotropic minerals may be further divided in accordance with their behavior in polarized light, into uniaxial and biaxial.

Isotropic class.—This class includes all amorphous and isometric minerals. If a section of such a mineral be examined in polarized light under given conditions, the field of view remains dark and a revolution of the section in any plane produces no change in appearance.

Anisotropic class, uniaxial minerals.—Includes all tetragonal and hexagonal minerals. If a section of such a mineral, cut perpendicular to the vertical axis, be examined in polarized light under given conditions, the field of view remains dark in the center, but round this center is seen a series of concentric colored rings intersected by a dark cross. No alteration takes place when the section is rotated around the normal to its faces. (See models.)

Anisotropic class, biaxial minerals.—This includes all orthorhombic, monoclinic and triclinic minerals. If a section of such a mineral, cut at right angles to a line bisecting the angle of the optic axes, be examined in polarized light under certain conditions, the field of view remains dark at two points, each of which is the center of a series of colored rings which in one position are intersected by a dark cross. In another position the dark cross is replaced by two dark curved bands, or brushes, each of which passes through the center of one of the sets of rings. (See models.)

DISPERSION OF THE OPTIC AXES.

In all biaxial crystals there are three directions in which light ether is propagated with its maximum, minimum, and mean velocities. These directions are known as the axes of elasticity and are found in directions at right angles to each other.

The plane of the optic axes must include the axis of greatest and of least elasticity, these two serving as bisectrices for the acute and obtuse angles formed by the intersection of the optic axes. When the acute bisectrix is the angle of least elasticity the crystal is called positive, and when the axis is that of greatest elasticity it is called negative.

Crystals possessing three axes of elasticity have also three indices of refraction. Furthermore, the direction of the optic axes changes for rays of different colored light, giving a larger optic axial angle for some rays than for others. Such a change in direction is known as the dispersion of the optic axes.

The two cases possible are distinguished by writing $\rho > \nu$ when the angle for the red rays (ρ) is greater than for the violet (ν), and $\rho < \nu$ when the converse is true.

Orthorhombic dispersion.—In orthorhombic crystals the position of the three axes of elasticity corresponds with that of the crystallographic

axes; consequently the optic axes must lie in one of the three pinacoidal planes, and symmetrical dispersion takes place in this plane. The model shows the dispersion in this case. The position of the axes of elasticity is indicated by the white threads, that of the optic axes by the red and blue threads. The vertical axis is the acute bisectrix, and red (ρ) is greater than violet (v); hence $\rho > v$.

Monoclinic dispersion—In monoclinic crystals one of the axes of elasticity corresponds in position to the crystallographic axis *b*, and the other two lie in a plane of symmetry at right angles to it. Consequently there are three cases of dispersion possible, depending upon which two of the three axes lie in the plane of symmetry. These kinds of dispersion are: inclined, when the plane of the optic axes is the symmetry plane of crystal, in which case unsymmetrical dispersion of the axes and bisectrices takes place; horizontal, when the plane of the optic axes is at right angles to the plane of symmetry and the acute bisectrix and axis of mean elasticity lie in this plane; crossed, when the plane of the optic axes is at right angles to the plane of symmetry and the acute bisectrix corresponds to the crystallographic axis *b*, so that the obtuse bisectrix and the axis of mean elasticity lie in the plane of symmetry. The three models following show the several kinds of monoclinic dispersion, and are described as follows:

Inclined.—The dispersion in this case is unsymmetrical. The position of the optic axes is indicated by red and blue threads. Greenish-yellow is the acute bisectrix for red and orange-yellow for blue. The dark-green thread is the obtuse bisectrix for red and grass-green for blue. The crystallographic axes are in white, axis *b* corresponding to that of mean elasticity.

Horizontal.—In this case the dispersion is symmetrical. The position of the optic axes is shown by the red and blue threads. Orange yellow is the acute bisectrix for red and greenish-yellow for blue. The crystallographic axes are in white, with axis *b* the obtuse bisectrix and not dispersed.

Crossed.—The dispersion in this case is symmetrical. The position of the optic axis is shown by the red and blue threads. Grass-green is the obtuse bisectrix for red and dark-green for blue. The crystallographic axes are in white, with axis *b* as the acute bisectrix and not dispersed.

Triclinic dispersion.—In triclinic crystals none of the axes of elasticity correspond to the crystallographic axes; consequently they have no fixed position. Complete unsymmetrical dispersion of the optic axes, their plane, and of the bisectrices takes place.

The model shows the unsymmetrical dispersion. The position of the optic axes is indicated by the red and blue threads. Orange-yellow is the acute bisectrix for red and greenish-yellow for blue. The grass-green thread is the obtuse bisectrix for red, dark-green for blue. The crystallographic axes are in white.

F—CHARACTERS DEPENDING UPON THE ACTION OF THE SENSES.

TOUCH.

The touch of a mineral is described as: greasy, the feel of talc; meager, dry and rough to the touch like chalk; harsh, having the feel of actinolite; smooth, having the feel like a face of a quartz crystal; adhesive when it adheres to the tongue, as in the case of hydrophane.

TASTE.

The taste is a character of soluble minerals only, and is described as: astringent, the taste of chalcanthite; sweetish astringent, the taste of kalinite; saline, the taste of halite; alkaline, the taste of natron; cooling, the taste of niter; bitter, the taste of epsomite.

ODOR.

Certain minerals, under the influence of friction, moistening with the breath, or by the action of heat or acids, give off odors, which are designated thus: bituminous, the odor of bitumen, as in elaterite; sulphurous, the odor of burning sulphur, as in pyrite when heated or under friction; alliaceous, the garlic-like odor given off by arsenopyrite when heated or under friction; fetid, the odor of sulphureted hydrogen given off under friction by some varieties of quartz and limestone; argillaceous, the clayey odor given off by kaolin upon being moistened.

G—CHARACTERS DEPENDING UPON RESISTANCE TO CHEMICAL ACTION.

CORROSION FIGURES.

When a crystal is exposed a short time to the action of a solvent, its faces are not equally attacked, but are corroded into pit-like figures whose forms obey the law of symmetry of the crystal. These figures are often of assistance in determining the grade of symmetry of a crystal, which is not apparent by the development of its faces. Corrosion figures will also indicate the presence of twins. Examples of these are shown in a crystal of pyrite which has been dipped in warm nitric acid, and in those of calcite, boracite, barite, galena and quartz.

SOLUTION PLANES.

In every crystal there is a set of structure planes along which chemical action takes place most easily. These planes have definite relations with the symmetry of the crystal; for example, the solution planes in the specimen of calcite shown are parallel to the faces of a scalenohedron. Further, in many crystals, when they have been subjected to intense strain, planes of easy solution may arise in directions parallel to that along which the strain is exerted.

TE PITO TE HENUA,

KNOWN AS RAPA NUI; COMMONLY CALLED EASTER ISLAND, SOUTH PACIFIC OCEAN.

Latitude 27° 10′ S., Longitude 109° 26′ W.

BY

GEORGE H. COOKE,

Surgeon, United States Navy.

TE PITO TE HENUA, KNOWN AS RAPA NUI; COMMONLY CALLED EASTER ISLAND, SOUTH PACIFIC OCEAN. LATITUDE 27° 10′ S., LONGITUDE 109° 26′ W.

By George H. Cooke,
Surgeon, United States Navy.

INTRODUCTION.

The U. S. S. *Mohican* sailed from the port of Callao, Peru, March 6, 1868, under orders for a protracted cruise, on special duty, among the islands of the South Pacific, with instructions, on her return passage to the South American coast, to call at Easter Island, make certain investigations desired by the Smithsonian Institution, and especially to bring away one of the colossal stone images to be found upon the island.

After a passage of thirty-two days the Marquesas group was reached, but the authorities, wishing to impose quarantine upon the ship, a stay of a few hours only was made, and we pushed on to the island of Rairoa, in the Tuamotu, or Low Archipelago. From thence the ship visited, at various times, and in some instances repeatedly, the Society Islands, the Samoan Group, the Tonga Group, the Fiji Islands, and New Zealand, and took her final departure from Tahiti for Easter Island and the South American coast November 16, dropping anchor in Hanga Roa Bay, west coast Rapa Nui, December 18.

The stone image, stone crown, and stone head, for the Smithsonian Institution, having been successfully transported over the island to the beach and thence transferred on board, the ship sailed on the last day of the year for Valparaiso, Chile, arriving at the latter port January 14, 1887, having performed the duty assigned her, in which all on board took the liveliest interest.

The writer has confined himself, as strictly as circumstances would admit, to the line of investigation assigned him, in order that there might not be a needless repetition in the reports of the several officers concerned in the work.

In the preparation and collation of the glossary the writer has been ably assisted by Lieut. William E. Safford, U. S. N.

EXPEDITION AROUND THE COAST LINE.

The investigations upon which this report is based cover a period of twelve days, from December 19 to December 30, 1886, inclusive, and were conducted in association with two other officers (the paymaster and the navigator) of the ship, to whom, as to the writer, special duties, predicated upon the information desired by the Smithsonian Institution, were assigned, respectively.

The *Mohican* anchored in the roadstead of the Hanga Roa, Rapa Nui, in the forenoon of Saturday, December 18, and on the morning of the 19th the writer proceeded ashore and immediately began his duties. On that day the crater of Rana Kao was visited and a general inspection was made of the stone huts, the painted slabs in their interior, the sculptured rocks, etc., and of the crater itself, in the immediate vicinity of which these objects of interest are located. At 3 o'clock p. m. the party returned to the house of Mr. John Brander, near the base of the volcano, from which we had taken our departure in the morning, and toward evening, mounting a wagon, were driven to the residence of Mr. Alexander P. Salmon at Vaihu, distant 5 miles, on the southeast coast of the island and formerly a Catholic mission.

At an early hour on Monday morning, December 20, we were driven back to the house of Mr. Brander, obtaining a view of the Obsidian Mountain as we skirted its base, and shortly after ascended Rana Kao, accompanied by a detail of men from the ship, with the necessary implements and instruments for making excavations and surveying. Private Anton Ayasse, of the marine guard of the ship, a clever draftsman, also accompanied the party for the purpose of making sketches of objects of interest.

The entire day was passed upon the mountain and a large amount of work performed, in the way of exploring the stone houses, inspecting the sculptured rocks in the vicinity, excavating, etc. Toward evening the descent was made and the night was passed at the house of Mr. Brander with somewhat more of comfort than had attended the previous one.

On the following morning, Tuesday, December 21, early preparations were made for the expedition around the entire coast line of the island. Four native men, named Huki, Luka, Haie, and Brotto, were engaged as guides and general utility men, with two pack horses for carrying camp equipage and provisions. Nine men, including the chief quartermaster of the ship, a boatswain's mate, and private Ayasse as draftsman, were detailed to accompany the party with tools for excavating, etc. The paymaster and navigator, with the writer and a naval cadet as assistant to the navigator, comprised the officers, and a young American, Mr. Frank Allen, in the employ of Mr. Salmon, went along as interpreter.

All being ready, the party started from the house of Mr. Brander at

8 o'clock in the morning of the day mentioned, and, passing through the villages of Mataveri and Hanga Roa, struck the coast line abreast of the ship at Hanga Roa Bay on the western side of the island, and thence proceeded in a northerly direction. The indentations of the coast were closely followed; every part of the ground carefully examined; each image platform discovered was accurately measured and platted on the chart prepared for the purpose; the number of stone images was noted, and where there were "indications" excavations were made; crania, when uncovered and in good condition, were preserved; caves were visited and searched; the bearings of promontories, points of land, mountains, etc., were taken for corrections on the chart, and so on. The work was tedious and laborious; the ground gone over was rugged and uneven, rocky at times, at others densely strewn with volcanic bowlders of every shape and size, the sharp points of which proved very trying to the feet. Again, our path lay over ground covered with hummock grass, the hard tufts of which made insecure footing and caused frequent turning and spraining of the ankles. Then, too, it was necessary to retrace our steps oftentimes, as well as to follow the windings of the cliffs, so that, although constantly moving from place to place, our progress in a direct line was slow and the work exhausting in the extreme.

Toward the middle of the afternoon two of the natives, who were thoroughly acquainted with the region and who reported "good water" at a certain point ahead, with two of our own people, taking with them the pack animals, were sent forward to select a camping place for the night. Subsequently one of the natives returned and piloted us to the point selected, at a considerable distance from the sea, which we reached at 5 p. m., weary but in excellent spirits. We found here an inviting-looking place, covering a space of about a hundred feet square, inclosed by a stone wall and with banana trees, stalks of sugar cane, and taro growing in profusion. Inside was the opening to a small but comfortable cave, sufficiently large to accommodate all our people, who were assigned to it, while a tent, improvised of blankets and waterproof coats, was erected outside the inclosure against another stone wall for the accommodation of the officers. It having been suggested by the writer that for convenience of future reference we name our nightly stopping places, this, our first night's abode, was, by unanimous consent, christened "Camp Mohican."

Although the distance on the chart in a straight line from our starting point in the morning to the site of our first camp measured but about 5 miles, we must have traversed fully three times that space in going around headlands and bays, crossing and recrossing, inspecting and measuring platforms.

Soon after a hearty meal, a constituent of which was baked lamb, Rapa Nui style (18,000 head of sheep roam the island), and a comfortable smoke, darkness coming on, all hands turned in for the night, the

men into their cave, the officers into their tent. Previously to doing so, however, we took precaution to stuff our ears with paper, in order to exclude the "snapping beetle," one of the *Elateridæ*, credited by the natives with a predilection for that organ, and myriads of which had been assailing us.

Our bed was composed of the moku—native grass—over which we placed our rubber sheets. At 2 o'clock in the morning we were awakened by a heavy rain storm, against which our flimsy patchwork tent proved but poor protection, the water either pouring through or running under our bed of litter.

On Wednesday, December 22, after a hearty breakfast, finding that we were none the worse for the previous night's experience, we struck camp, the pack animals were loaded, and at an early hour we were under way again. Our course this day continued along the coast line to the northward and around North Cape, skirting the base of Rana Hana Kana. The shore all along this part of the island is bold, rocky, precipitous, the black frowning basalt cliffs rising in many places to the height of hundreds of feet, truly an "iron-bound" coast, upon which the seas break with terrific fury, dashing the spray high in the air. The powerful solvent action of sea water upon even the hardest volcanic rock may here be seen exemplified in the fantastic shapes wrought by the waves on every side, the arches cut through, the innumerable caves excavated in the face of the cliffs, the pinnacles, towers, basins, etc., visible at every step. Many of the caverns were explored, and human and other bones found in some of them. The character of the surface land was about the same as on the preceding day, and the tramp over rocks and stones was a weary and trying one.

During the afternoon a detail of men was again sent ahead to locate the camp for the night, near a fresh-water spring known to the natives, and which the remainder of the party reached toward sunset. This, which we named "Camp Day" in honor of our commanding officer, was situated in the district of Vai-maitai (good water), near Motukau Point, about 3 miles distant from our camp of the night before, but fully three times as many by the route we had taken. One of the natives was sent back to the ship, with a note, for additional supply of stores. Two caves were occupied at this camp, one by the officers, the other being allotted to the men.

Despite the promising name of the district, the water again proved bad, being brackish. A couple of sheep had been captured and dressed, and from these and canned food, garnished with taro, sweet potatoes, and bananas, baked by the natives in their inimitable way, and washed down with copious drafts of tea, an excellent meal was made. Our cave proved a damp, ill-smelling place, and visions of pneumonia, rheumatism, and other resultant affections dominated our dreams, rendering sleep fickle and unrefreshing.

At 7.30 on the morning of Thursday, December 23, we were again

under way and continued our route along the cliffs on the north shore of the island. At platform No. 29 a pit was excavated in which a collection of human skulls, without any other portion of the remains, was found. Our track this day led us to Anakena Bay, according to tradition the original landing place of King Hotu-Metua, his queen, and followers, from whom the present inhabitants claim their descent. We found at the head of the bay a fine, extensive sand beach, the first we had fallen in with, forming a good landing place for small boats. The breakers and still water in the vicinity were seen swarming with fish of several varieties, of which the natives gave us their names. The sand beaches were thickly strewn with the "Portuguese man-of-war" (*Physalia utriculus*), called by the natives *Papaki*, and which, to the writer's great surprise, they informed him was eaten by them as food. Adherent to the rocks was found the singular, cuirass covered little creature, called by the natives *hemoma*, one of the *Chitons*, perhaps the *magnificus*, which is also used by them as an article of diet. Thus, also, a small univalve, called by them *ngingongi*, large collections of the shells of which were found stowed away in the walls of the stone huts at the edge of the crater, on Rana Kao, where also was found the remains of the *Chiton*. The sea urchin, *Echinus esculentus?*), in Rapa Nui-*hetuki*, and a diminutive snail, which they call *pipi*, were found at Anakena. All the above form a part of their dietary, and they seemed to speak of and regard them as tidbits.

Sometime was passed at Anakena, exploring its vicinity where, there is every reason to suppose, an extensive town existed, for which the nature of the surface, ascending gradually from the water's edge to high land on either side, with a hill rising between and running back into the interior, forms a most admirable site. The remains of former habitations were found in various directions. At some distance back from the sea on rising ground, in an isolated position, far removed from any platform or image, was found the largest tufa crown we had yet seen and which subsequent investigation proved the largest on the island. It was slightly oval in shape, lay on its side, was buried in the earth to a depth of about 2 feet, and by actual measurement was 27 feet 9 inches in circumference, 9 feet 9 inches in diameter across the long and 9 feet 2 inches across the short oval, and 9 feet high.

Beyond Anakena Bay the walking became especially difficult and laborious at one point, near Ovahe Bay, it was necessary to scale the face of a cliff, at about midway of its height, on a narrow ledge of rock.

Our camp, named "Whitney," for the honorable Secretary of the Navy, was located for this night near Hangaone Bay, about 4 miles from our starting point of the morning, and it was nearly dark when we entered its welcome precincts. Supplies from the ship, brought by the boat, which had been nearly all day reaching Anakena, were carried thence overland and arrived in camp during the evening.

Near our present camping ground we found the best water of any

during our entire trip and we duly commended our guides, accordingly, much to their gratification. I was much surprised when, next morning, on visiting the well, or spring, situated immediately adjoining one of the image platforms, I found it nothing more than a shallow excavation among the loose stones, and covered in order to keep the cattle and sheep from drinking the precious fluid, of which there was but a few inches in depth remaining. The water was surface water only, and had percolated between the rocks, into the cavity, after rains. The knowledge that these image platforms, have, from time immemorial even unto the present day, been utilized as burial places by the natives, did not enhance our enjoyment of the liquid.

The men slept in a comfortable cave that night, and for our own accommodation an overhanging shelf of rock was economized. This was too narrow to entirely shelter the party, and the deficiency of rock was, therefore, supplemented with blankets, banana leaves, etc., laid upon cords stretched in various directions. The scheme proved a delusion, for the post-midnight showers descended as usual, the banana leaves formed admirable conduits to lead the water where it did the most harm, and the customary hasty vacating of the den in the night was the inevitable result. These successive nocturnal experiences served to impress on our minds the absurdity of leaving the ship unprovided with a suitable tent, or at least an old sail with which necessary shelter could be improvised.

We struck camp and got away early, sending the camp builders with the pack animals overland to the south side of the island, where at a certain place, as the natives informed us, a fine, roomy cave and good water would be found, and which was decided upon as our next camp.

Our own course continued along the north coast around Cape Pokokoria, along the east shore to Cape Anaataavanui, and thence in a westerly direction along the south coast to camp, near Hanga Nui Bay and Point Onetea.

During the early part of the day the ground was of the same rugged nature as that already passed over, but on reaching the base of Mount Pua-ko-taki, at the eastern end of the island, the character of the surface changed, being covered with hummock grass, alternating with extensive tracts of fine, red volcanic sand, and dust, more particularly on the northern and eastern slopes of the mountain. It was asserted that in this red sand most of the stone axes and other implements were to be found, particularly after strong gales, when they were uncovered by the wind, and careful search was made accordingly, but with indifferent success. After luncheon, partaken of on top of the mountain, the descent, which was gradual, as was also the ascent, was made on the eastern side, the ground being of the same sandy nature. Diligent search was again made while traversing this, and a few specimens of stone implements, in large part mutilated, were obtained.

In traveling southward, along the slope of the mountain, on again approaching the region of grass it was singular to observe the line of demarcation. The sand, moved by the winds, was gradually encroaching upon the vegetation, the depth of the edge being about 6 inches. The contrast between the deep red of the one and the vivid green of the other was very striking, and the line was as straight, regular, and clearly drawn, with fertility on one side and barrenness on the other, as any of a similar nature seen by the writer in Egypt.

The walking upon the sand, although tiresome, was easy as compared with that on the hummock grass, over which our route now lay. In our journeyings theretofore, although there was no regular paths and of course no roads, we were fortunate enough occasionally to strike a sheep or cattle trail, which afforded a welcome relief, however brief, to our jaded feet. There was nothing of the sort now—no avoiding of rough places, no choice of spots to plant a foot—and as we moved grimly onward, blundering at every step, the distance around Cape Anaataavanui seemed interminable. Thoroughly fatigued we reached the precipice, which terminated the plateau over which we had been struggling, and looking to the westward saw the welcome flags, still a mile distant, waving over our camp. The descent of the precipice at the point reached being precarious, its edge was skirted until a more favorable place was found down which to scramble to the plain below. Here we presently struck a trail, which soon opened into a wagon road, whence a footpath led to the camp, which the writer (the party having been scattered since noon) reached at 4.30 in the afternoon.

The situation of the camp, which was named "Baird" in honor of the secretary of the Smithsonian Institution, was a delightful one, being located on the south side of the little bay of Hanga Nui, at the base of a bluff which partly sheltered it from the strong southeast trades, as well as the hot afternoon sun. Rana Roraka, from the crater and slopes of which all the monoliths on the island had been quarried, lay immediately to the left. Pua-ko-taki, over whose summit and around whose base we had toiled, loomed in front of us. Lying in the opening of our cave, we could gaze upon the great platform, Tongarika, with its fifteen prostrate stone images, the largest and most imposing on the island. At our feet, surging back and forth among the everlasting rocks as the swell rolled in from the open ocean, lay the sparkling waters of the Hanga Nui Bay.

The cave, called "Ana Havea" by the natives, ran back into the bluff a distance of 50 feet or more and laterally about 30. The entrance was spacious, and it was roomy, dry, and well ventilated, the trade wind, deflected by the bluff, sweeping nearly across its face. It was an ancient cavern, had been inhabited by the image builders, and was still occupied at times by the natives, as also by Messrs. Salmon and Brander when in this part of the island, engaged in rounding up their herds of cattle or sheep. The floor was strewn with dry litter, bull rushes and

grass. There were several elevated platforms, edged off with bowlders, which were for sleeping places, and the remains of an ancient fireplace could be traced in one corner. Two huge rocks, with a flourishing tobacco plant growing between, guarded the entrance, from which a grass-covered lawn inclined downward to the rocks at the water side.

The men were accommodated in another comfortable cave at about 100 yards distance inland, and the camp fire was kept brightly burning in a clear space among the bowlders on the declivity hard by.

At no time during our trip were we without food. On the contrary, sheep were plentiful all over the island. Drinking water, so indispensable, and yet so scarce on Rapa Nui, was obtained from several sources near Camp Baird, but all was equally unpalatable. Our first supply (we remained at this camp about three days) was obtained from a so called well, half a mile distant, located among the rocks near the edge of the bay, and was salt at high water and more or less brackish at all times.

The water from a spring discovered by Quartermaster Lowrie was also unpalatable, and a supply obtained from the crater of Rana Roraka, near by, owing to its animal and vegetable impurities, was more so. It is to this crater that by far the larger number of cattle resort to drink, and their grazing ground, for this reason, is mostly located on this part of the island.

On the evening of our arrival, December 24, having partaken of a hearty dinner and lighted our cigars, we stretched ourselves, weary and foot sore, on the grass in front of our cave. The conversation, brisk and merry at first, soon flagged, became desultory, and presently ceased entirely. It was "the night before Christmas;" our mere physical, corporeal nature was pressing the soil of Rapa Nui, but the spirit, our immaterial part, was many leagues away.

At various times during our stay the writer purchased crania which the natives offered him for sale, and among these were several skulls of ancient Kings, bearing peculiar marks which, Mr. Salmon assured him, he then saw for the first time, and of the genuineness of which he had no doubt.

Christmas forenoon was passed in exploring the region in the vicinity of the camp, several cairns being opened with variable success in the matter of specimens. In the afternoon the crater of Rana Roraka was visited and note taken of the very numerous finished and unfinished images, some standing, others prostrate, scattered over its slope and the great plain at its base, where there is every reason to believe once stood a populous town. The quarries, "workshops," were also visited and the many partly completed monoliths, still attached to the original rock, examined. As in Egypt, where, in the quarries at Syene, near the First Cataract, the largest obelisk still lies unfinished, so here, in one of the excavations on the outer slope of the crater, may be seen the largest of the stone images to be found on Rapa Nui in an incomplete

condition, still adherent to the bed rock and measuring 69 feet 9 inches in length.

That evening, after dark, the natives remaining with us entertained us with an exhibition of their manner of capturing the crayfish. Stripped to the skin and holding aloft in the left hand a hugh lighted torch composed of loose fagots, they would jump from rock to rock and bowlder to bowlder with the agility of monkeys. Peering into the depths below, and having discovered their prey, they would leap into the water, often to their necks, deftly seize the crustacean and pass it to a companion who, with another burning torch, attended them for the purpose. Again they would sight their game in a cleft, or under a submerged overhanging rock, and, swiftly inserting the hand, would rarely fail to bring forth a captive. For an hour or more the sport continued. The sight was a strange, wierd, savage, and interesting one, and the array of *ura* (Rapa Nui for crayfish), which at the termination of the hunt they proudly spread before us gave ample testimony to their dexterity.

Sunday, December 26, the writer passed quietly in camp, and the following day was devoted to further explorations and excavations.

Tuesday, December 28, we broke camp and abandoned Ana Havea, which had so long sheltered us, all the party, except the paymaster and writer, returning across the island to the ship, which had been moved around to La Perouse Bay, on the north side of the island, for the more convenient transportation on board of the selected image.

In company with Mr. Salmon, who had passed the previous night with us at the cave, and riding with him in his "buggy," we were taken to his house at Vaihu, formerly a Catholic mission but now abandoned as such. The church and parsonage, with outbuildings, are still standing, the former being used in part as a storehouse, while in the remaining portion divine service is held daily under native leadership. The parsonage, comprising three rooms, is occupied by Mr. Salmon as his dwelling, and he has here displayed a portion of his very curious, interesting, and valuable collection of Rapa Nui antiquities.

It is but just to note, in this place, that too much credit can not be awarded Mr. Salmon for the great interest he takes in everything pertaining to the island—its history, its people, traditions, and remains. He is an enthusiast upon this subject, has made it a study of years, and has devoted time, money, and his best energies toward assisting in elucidating the mystery which envelops this isolated mid-ocean island, its hieroglyphs, its rock carvings, its colossal remains and the strange people who wrought them. Mr. Salmon has resided here for a period of seven years in all, and during that time, in addition to his large collection, he has made a study of his subject, has interested himself in the natives and their improvement, and has accumulated a large amount of information, legends, and traditions, which otherwise, perhaps, would in a few years have perished with the people

to whose ancestors it relates and who seemed to be doomed to speedy extinction.

During our stay at the island we were treated with every courtesy by Mr. Salmon, who placed every facility within his power at our disposal for the prosecution of our work, and I am indebted to him for much of the information embodied in this report.

Wednesday, December 29, was devoted to explorations in the vicinity of Vaihu, to the collection of data, and taking of notes, and at 7 o'clock in the evening drove to Mr. Brander's house, near the village of Mataveri, having thus completed the tour of the coast line of the island. That evening, in company with Mr. Salmon, a visit was made to Chief Ure Vaeiko, 83 years old, for the purpose of having him interpret the hieroglyphic writings on the wooden tablets and photographs. This he did into the Rapa Nui language, the interpretation being taken down by Mr. Salmon, stretched at full length in the litter constituting the floor of the house, and subsequently translated into English by him. The latter, with the paymaster, was engaged with this work through the entire night, and at 10 o'clock next morning, the 30th, met the writer at Mr. Brander's house. A large portion of this day was devoted to visiting the villages, inspecting the houses, and making physical examinations. At 5 o'clock in the afternoon we returned to the house of Mr. Salmon, at Vaihu, where a note from the ship was received urging our immediate return, as the image had been received on board and the *Mohican* was to sail on the following day.

Another night was passed at the house of Mr. Salmon, and at 7 o'clock on the morning of December 31, our preparations being completed, we started on our return. The "buggy" was again brought into requisition and carried us as far as Rana Roraka, the road terminating at the corral at its base. Here we alighted, and the natives distributing and shouldering our implements, all hands except Mr. Salmon, who rode on horseback, struck out to cross the island on foot to La Perouse Bay. The distance was about 3 miles by the trail, which was rough and rocky but quite level, and was accomplished in an hour. On the way we passed our camp of December 23 and 24, "Whitney," where a party of native men and women had spent the preceding, and it is to be hoped a drier, night than we did under the overhanging rock.

We arrived at the landing in Hanga-one Bay, whence the image had been boated off to the ship after having been brought a distance of 2½ miles overland on a sled, at about 9 o'clock in the morning, and in a little while thereafter returned on board after an absence from the ship of twelve days. At 3 o'clock the same afternoon, all financial matters having been concluded, and a number of sheep, the parting gifts of Messrs. Salmon and Brander, having been received on board, we bade farewell to our gentle Rapa Nui friends and steamed away for Valparaiso.

We found the natives who accompanied us bright, willing, tractable,

tireless, anxious to please, and ready at all times, day or night, to do our bidding. Two of them, Luka and Huki, were especially useful to us. The latter was the more intelligent of the two, and was remarkably well informed regarding everything pertaining to the island. He knew the name of every point, headland, bay, etc., and his replies to our questions were given without hesitancy and so correctly, as we found by testing him, that he frequently surprised us. The writer obtained much information from him, and might have gained much more, regarding the native plants, insects, shells, etc., but unfortunately our interpreter, who had been but a short time on the island, was practically useless as a medium between us, and to understand each other's meaning was therefore most difficult. Owing to this fact, the want of facilities and conveniences for collecting and preserving specimens, and the absence of works of reference, but little could be accomplished in the particulars above mentioned.

A source of great annoyance to us during our trip was the hordes of flies which kept us company on the march, and then whenever we approached camp in the evening were greeted and cordially welcomed by other hordes which had been in previous possession of the locality. Many of the islands of the South Pacific are noted for the swarms of flies which infest them, one Rairoa, having been named by the navigator Schouten, 1616, Vliegen Islands by reason of the myriads which assailed and finally drove him to sea.

Another, and in some respects even worse plague, was the fleas, which had their origin in the numerous dogs kept on the island.

One more source of discomfort, in connection with our stay at the hospitable residence of Mr. Salmon, was the host of cockroaches which swarmed every part of the premises, measuring 2 or more inches in length, with antennæ to correspond, and furnished with wings of a beautiful glistening brown.

TOPOGRAPHY.

From the most reliable information obtainable it appears that the ancient name of the island was *Te Pito te henua*. Referring to the vocabulary it will be seen that the word *Pito*, in Rapa Nui signifies *navel*, and *henua*, the *uterus*. What association of ideas could have prompted these appellations it is, of course, difficult to imagine at the present day. The following speculations, which have occurred to the writer, are given for what they may be worth. The island is distinctly of volcanic origin, and on nearly all the hills and mountains the craters are clearly traceable, most markedly and startlingly so in the case of Rana Kao, at the southwest end. As will be seen, the craters of both volcanoes (all on the island are now extinct) are of great depth, with lakes of water at their bottoms. In the cases of the other volcanoes the craters are much more shallow, symmetrical, more evenly rounded, overgrown with grass, present a very striking and beautiful appear-

ance, particularly when the slanting rays of the rising or setting sun shine upon them, and at that time especially, when they stand so prominently forth, would readily suggest the human navel, from which it may be inferred that portion of the name of the island might be derived.

Regarding the other word, *henua*, the *uterus;* can it be that they meant to designate by this term the great volcano Rana Roraka, in whose womb was created, and from whose vitals was born that host of monolithic images which once reared their colossal forms aloft, giant genii guarding these rock-bound shores, and which to-day, prone and mutilated as they are, fill the mind of the voyager with wonder, awe, and admiration?

Hiti te eiranga, the name said to have been given to the island by the English is, perhaps, a corruption of that above-mentioned, as is certainly also the name *Te Pito fenua*, wrongly stated as signifying "the land in the middle of the sea." The name *Rapa Nui*, signifying Great Rapa, is modern, having been given to the island by the Tahitians twenty years since, to distinguish it from *Rapa iti*, Little Rapa, otherwise called Oparo, an island lying 1,900 miles to the westward, in the direction of the Society Group, which latter is 2,500 miles distant. The name Easter was given the island by Roggeween, who discovered it on Easter Sunday, 1721. It has also been called by various names, such as Teapy and Waihu.

It has often been subject of remark that this propensity of giving new, modern, European names to lands and islands, not only when originally discovered, but often when merely revisited, may be considered as not only in questionable taste, but as leading to endless confusion. The charts and Sailing Directions are replete with instances of that sort, cases occurring when perhaps half a dozen modern and strangely appearing names, each by a different navigator, are applied to one small island or group of islands. The spelling of the native names is also, in many instances, wide of the mark. These strictures may be said to apply with special force to the island under consideration, and, therefore, in these reports and on the corrected chart its ancient name, as well as the native names of its mountains, bays, and headlands, have been adhered to as closely as practicable, while at the same time the greatest care has been exercised in spelling them phonetically as received from the natives.

Since its discovery the island has been visited at successive times by Cook and La Perouse; by the H. M. S. *Blossom* in 1825, and *Topaze* in 1868; by the Chilean gunboat *O'Higgins* in 1870 and 1875; by the H. M. S. *Sappho* in 1882, and by the German gunboat *Hyæne* in the same year.

The U. S. S. *Mohican* arrived at the island December 18 and sailed December 31, 1886.

The distance to the nearest inhabited island to the westward, Pit-

cairn, is 1,100 miles, and the South American coast is 2,100 miles to the eastward.

The island is irregularly triangular in shape. Its greatest length from NE. to SW. is 13 miles; its greatest width from North Cape to Cape Hoe-Hoe, in a direction from NNW. to SSE., is 7 miles. The circumference, measuring from headland to headland, is about 34 miles, and the area of the island is 34 square miles.

The surface is diversified mountain and plain, the former usually rising abruptly from the latter, and generally at a distance from each other, so that, with one or two exceptions, it can hardly be said that there are valleys, strictly speaking. The mountains—a goodly number in proportion to the area of the island—are mostly cone shaped, and not of very great elevation, the tallest, near Cape North, being but 1,767 feet high. The most extensive plain is at the base of Rana Roraka, extending thence in a westerly direction for several miles, and it is believed that in ancient times a large town existed on this site, in whose vicinity all the monoliths were carved.

The coast line on the southern and western sides, except at the extreme southwest end where Rana Kao looms up, is generally low, but extremely rocky. The northwestern, northern, northeastern, and eastern coasts are a succession of black, frowning, precipitous, basalt cliffs, worn into innumerable caves by the erosion of the sea, and with huge attached bowlders scattered at the base, over and against which the waves dash with resistless fury, forming a veritable iron-bound coast. Many of the caves thus formed have been inhabited and have also been used as burial places; and the remains of human beings, with implements interred with them or secreted by the modern natives, sometimes reward the diligent searcher.

There are but two or three points around the entire coast line at which a sandy beach may be met with. One of these, small in extent, is on the south side, near Mr. Salmon's residence at Vaihu, in a picturesque little bay, used as a bathing ground and boat landing.

Another, and much the larger, forms the beach of Anakana Bay on the north side of the island, the legendary landing place of Hotu Metua, and by far the best and safest boat harbor around the coast.

The soil is for the most part decomposed or disintegrated lava, nowhere of any great depth, but exceedingly fertile and in places, as for example, where excavations were made inside of cairns, it was found of the fineness, color and richness of garden mold.

Except where a few clearings have been made, nearly the entire surface of the island is covered in astonishing profusion with fragments of lava, varying in size from that of a pebble to that of a huge bowlder. They are nearly black in color, hard, sharp, angular, weatherworn; and it is these, in places *covering* the ground, which render pedestrianism so difficult and laborious.

Until supplied with wood from wrecked lumber vessels the modern

natives built many of these huts, the cairns for the dead, and other buildings, of these lava blocks, loosely piled up, and Messrs. Salmon and Brander apply them to good use in constructing their extensive corrals and fences, with the added advantage of thus clearing the soil for planting, wherever desirable.

A coarse hummock grass and a variety of finer quality grow profusely over nearly the entire island, sprouting vigorously among the lava fragments, and affording abundant pasturage for the herds of cattle, horses, and sheep, the former numbering 600 and the latter 18,000 at the time of our visit, and both multiplying rapidly.

On the northeastern end of the island, and on the slopes of Mount Pua-ko-taki, the surface is covered with fine, red, volcanic sand and dust, which is kept in constant motion by the winds, and is barren of vegetation of any kind.

At the time of our visit, December, which is during their dry or summer season, extending from October to April, the periods of the southeast trades, there were no running streams on the island, nor, with the exception of the valley at the base of Rana Kao, were there any evidences of the former existence of such visible. Fresh water away from the habitations was exceedingly scarce and difficult to obtain, although showers of rain at night were not infrequent.

The alleged springs or wells, including *Puna Pua*, the "Unfailing Spring," so highly spoken of by former visitors, were at long distances apart, were merely shallow excavations among the bowlders into which the surface water percolated, and were covered to protect them from the animals. The water contained in them was rarely of more than a few bucketsful in quantity, and with a single exception, at Camp Whitney, of bad quality. That contained in the lakes inside the two craters, the accumulations of the rainy seasons, and surface drainage also, was fully as bad, and impregnated both with vegetable and animal matter, the former from the dense growth on the surface, the latter from the herds of cattle which came to the lakes to drink.

It may be mentioned in this place that the natives, from long habit, no doubt, have become accustomed to drink but sparingly. We were surprised, during our expedition around the island, to notice how rarely they resorted to the canteen, with which all were provided, and they, no doubt, were equally amazed at our constant demand for water, made necessary to replace the loss from perspiration, induced by violent exercise and the sun's heat. They were always careful to locate our camp near, and anxious to keep us well supplied with, as good water as was to be had, and when we broke camp in the morning the "springs" in the vicinity were usually drained dry.

It was at first a mystery to us whence the animals obtained their supplies, but as to the cattle, they never wandered far away from the craters, in whose lakes they could, at all seasons, quench their thirst. In so far as the sheep were concerned, whose needs in this respect are

not great, no doubt the night dews, which are quite heavy on Rapa Nui, and with which the grass is loaded in the mornings, amply supply all their requirements in this respect.

At the habitations, the rain falling on the roofs of the houses was collected in iron tanks, and the water thus obtained was unexceptionable. During the winter season, April to October, when the winds are variable, there is ample rainfall, and fresh water is abundant.

Having no knowledge of the potter's art, earthen vessels are unknown, although red clay of fine quality is plentiful on the island. Neither does the cocoanut palm, so indispensable to the natives throughout Polynesia, grow upon the island, at the present day at least. A variety of gourd flourishes luxuriantly, however, and the fruit of this, properly seasoned, furnishes them with vessels for holding their water.

The flora of the island is a very meager one. Tradition has it that it was barren until King Hoto Metua, the "Prolific Father," with his Queen and followers, landed and took possession, bringing with them seeds and fruits.

Except in the immediate vicinity of the houses occupied by Messrs. Salmon and Brander, the island may be said to be treeless. In the places mentioned a few fig, acacia, paper mulberry, and other trees grew to a fairly good height. In other parts of the island may be seen, in places in considerable numbers, a hard-wood tree, more properly bush or brush, called by the natives *toromiro*. These must have flourished fairly well at one time, but are now all, or nearly all, dead and decaying by reason of being stripped of their bark by the flocks of sheep which roam at will all over the island. None of the trees are, perhaps, over 10 feet in height, nor their trunks more than 2 or 3 inches in diameter. The wood is exceedingly hard and heavy, somewhat resembling our apple, and the natives used, and still use it, to this day in making their house Gods, their Penates. These are rudely carved out of the solid wood, hideous imitations of the nude human form, male or female; 2 to 3 feet in length, with preposterous development of chest and preternatural collapse of abdomen, as though famine had brooded over the land and the patient had perished of inanition; with attenuated forms, long, slender arms and legs, narrow faces, a goatee, long, prominent ears, etc. In the eyes of these idols the iris is usually represented by a circular button of bone, generally cut from a human skull, while a fragment of obsidian, fixed in a round hole in the center of this, and which glistens in the light, makes a fair imitation of the pupil, both being deftly fitted in the wood of the ball. On the first occasion when the writer saw a skull from which several such buttons of bone had been removed for the purpose mentioned, he was impressed with the idea that the ancient Rapa Nuiis, like the ancient Peruvians in the time of the Incas, were acquainted with the operation of trephining and performed it in a much neater manner. Subsequent investigation speedily undeceived him on that point.

There are a few stunted trees and bushes growing near the water's edge, inside the great crater of Rana Kao. This remarkable volcano is 1,327 feet high. The diameter of the crater at the top is 4,150 feet. At the water line inside it measures 2,085 feet across. The depth from the top to the lake is 600 feet, so that the surface of the latter is 727 feet above the sea level. The crater is nearly a perfect circle and unbroken at its upper edge, except at a point at its southern side, toward the ocean, where exists a large cleft or notch, through which, no doubt, the lava, when the volcano was active, found its way to the sea, and perhaps assisted in forming the small adjacent islands of Mutu Nui and Mutu Raukau. It was to this latter island that their swimming matches were annually held, in the effort to see who should be the first to reach it, climb to the precipitous sides, and bring back one of the sacred eggs of the sea bird, to which they attached such a superstitious value, and which conferred kingship for the year on the lucky captor for his prowess. This rock, covered with birdlime, looks at a little distance like a huge inverted stalactite projecting high in air from the depths of the sea. The labor and difficulty involved in mounting it, therefore, may be imagined.

The interior of the crater (Rana Kao) is distinctly conical in shape, resembling a vast amphitheater, and presents a magnificent view. Trails lead to the bottom, in various directions, evidently the tracks worn by animals; but the descent, as well as the ascent, is most difficult, and but very few ever attempt the feat.

Grazing around the edge of the lake, as well as on the floor of vegetable matter floating on its surface, could be seen cattle which looked, at that dizzy height, of about the size of sheep, and sheep which appeared like rabbits. The lake at the bottom has been sounded by Mr. Salmon to a depth of 300 feet, when his line parted, without touching bottom. The surface edge is covered, over almost its entire extent, with a thick, dense, intertwined, vegetable growth, the accumulation of many years, from which grow small trees and bushes of considerable size. At various places, and few in number, over this floating, elastic, vegetable floor, which rises and falls as the water in the lake increases or diminishes in quantity, according as it is the rainy or dry season, are openings of variable size and irregular circular shape, through which the water appears, rippled by the passing winds, and to which the animals resort to drink. Around these openings the vegetation is of a vivid green, evidencing present and vigorous growth, as well as gradual but steady encroachment on the small remaining free surface of the lake, so that in course of time it will no doubt become entirely covered. Other portions of the vegetable mass are of a deeper shade of green, while still other and older parts are of varying tints of brown. Cattle and sheep may be seen browsing unconcernedly over various portions of the floating floor of vegetation, a curious and interesting spectacle, and instinctively, perhaps, avoiding the treacherous places

likely to precipitate them into the depths below. A path of planks has been laid to the edge of one of the openings, the more readily to enable the natives to obtain the water, which, as may well be inferred, is brackish and unpleasant to the taste and thoroughly impregnated with animal and vegetable matter, vast masses of the latter being in a constant state of decay.

The climate can scarcely be otherwise than salubrious and healthful. The southeast trades from October to April blow fresh at the beginning and end of the season. During our stay in December they were moderately strong, and the weather continued exceedingly pleasant. For the remainder of the year the winds are uncertain, westerly prevailing perhaps; the weather is changeable, and there is abundance of rain. Electric storms are unknown.

A psychrometrical record taken both on board ship, and to a very limited extent ashore, accompanies this report; as also a copy of the meteorological record from the ship's log during our stay at the island. In the latter the figures in the column "wet bulb" are not entirely reliable, by reason of the inadequate nature of the cotton siphon, which consists merely of a few strands of ordinary lamp wick and does not cover the bulb. With the exception of the two craters of Rana Kao and Rana Roraka, the bottoms of which form lakes, as already stated, and which are isolated and far from the habitations, there is no decaying vegetable matter to be found worthy of note, and the island may therefore be said to be free from malaria and the diseases of paludal origin. During the rainy season an occasional case of remittent appears, but it is of mild type; medication is not resorted to, and recovery takes place when dry weather sets in. So healthful is the climate, so simple are the habits of the people, and so isolated are they from contact with the outer world, and, consequently, the numberless malign influences which there hold sway, that diseases of any kind are very rare among the Rapa Nuiis, and they seem to be exempt from the ordinary ills of humanity. There are no "medicine men" among them, and they have no pharmacopœia worthy the mention.

During inclement weather a trifling "cough"—occasionally a case of pneumonia—a mild attack of rheumatism, may appear, and mention is also made of cerebral neuralgia. During our visit there was not, to the best of our knowledge, a case of acute disease on the island.

It is stated that from May to October occasional cases of asthma show themselves, which the natives attribute to eating deep water fish which have fed on a certain marine plant, the name of which the writer was unable to ascertain. This may be taken as delusion; and it may be mentioned in this place that a well-marked case of asthma, in the person of one of the *Mohican's* firemen, was notably worse and suffered severely during the entire period of our stay at the island.

A disease of the soles of the feet, which the natives called *kino*, consisting, according to their statements, as understood, of fissures and ulcer-

ations, was spoken of by them, and was attributed to walking barefoot over certain running vines usually growing among the rocks at the seaside. On reaching such places they seemed to avoid them, but nothing definite or reliable was elicited, and subsequent inquiries were overlooked in the hurry of departure.

VILLAGES AND HABITATIONS.

The villages on the island are three in number, Hanga-roa, near the bay of the same name, on the western side; Mataveri, within a mile of the former, and Vaihu, near Cape Hoe-Hoe, on the southerly coast of the island. Much the larger part of the population is gathered in the two villages first mentioned, between which the people are about equally distributed. At the first named is the church of the Catholic mission.

About a half mile south of Mataveri, near the base of Rana Kao, and separated from it by the most distinctive valley on the island, is the residence of Mr. Brander, the first erected and by far the largest, roomiest, and most convenient; modern-built, of wood, with lofty ceilings, and porches, and shade trees growing about it. It is, however, in a sad state of repair, and the evidences of neglect and thriftlessness are apparent everywhere.

Vaihu, which can no longer be called a village, is about 4½ miles to the eastward of Mataveri. It was at one time a Catholic mission, and the church and parsonage, still in a fair state of preservation, yet remain, together with a few outbuildings, all of which are occupied by Mr. Salmon and his employees, perhaps a dozen in all. Divine service, under the leadership of native "missionaries," is still held in one portion of the church, while the remainder is appropriated to other purposes, mainly for the storage of wool, obtained from the sheep, considerable quantities of which are shipped to Tahiti.

The habitations of the ancient image and platform builders, the stone huts on Rana Kao, will be described in other reports.

Until quite recently the house of the modern Rapa Nuiis were somewhat similar to those of the Fijians, being rectangular in shape, about 6 to 8 feet wide by 10 to 15 feet long, with nearly perpendicular sides, peak-roofed lengthwise, door on side, and thatched all over.

A few years since an Oregon lumber vessel was wrecked on the island and much of her cargo, which consisted of boards, scantling, etc., was brought ashore. Of these, under suitable instruction, the natives built themselves houses, and nearly all are now domiciled in comparatively modern style habitations and far more comfortably than formerly. These houses, which after all have a very forlorn look, are from 15 to 20 or more feet long by from 10 to 15 feet wide. The weatherboards are neatly fitted to the frame of scantling, and they are covered with a board roof. There are usually two doors hinged opposite each other on the long sides of the house, and a small window or two close by the entrances, and sometimes glazed, admit a feeble light when the doors are closed.

In place of plank floors the bare earth is strewn with dried bulrushes and grass to the depth of several inches, and as this litter is rarely renewed, the result is obvious. Occasionally a bunk may be found knocked up at one end of the single apartment of which the house consists, or, as in the more pretentious houses, a square bedstead may be seen, built of planed, unpainted wood, with a wild attempt at scroll carving about the head and foot boards. Chairs and tables are unknown luxuries.

The same house is often occupied by several families, or by several generations of the same family, but as the individuals composing these are never very numerous there is no overcrowding.

A few of the more ordinary cooking utensils may occasionally be seen, but as a rule the natives, as is generally the case among the inhabitants of the South Sea Islands, prepare their food in stone ovens in the following manner: A circular excavation is made in the earth outside of the dwelling, several feet in diameter and a foot or two in depth, which is then neatly lined with a porous stone of some sort. Other stones are loosely laid in, and a quantity of dry wood or brush of any kind, with more stones, piled on. The wood is then set on fire, and, when the stones have become sufficiently heated, the loose ones are taken out, and the brands and cinders removed, leaving the lining of heated stones intact. Over these is then spread a layer of banana, breadfruit, or other large leaves to keep the food from contact with ashes. The food, taro, yams, sweet potatoes, fowl, short, or "long pig," or whatever else there may be, previously prepared for cooking, is then placed on the layer of leaves, piece by piece, until all are in position, when the mound of food is carefully covered over with several thicknesses of large green leaves to prevent any dirt from falling in among the edibles. The heated stones, previously removed, are then placed in position all over the mass and finally a thick layer of fine, dry earth, ashes, and cinders is piled over all, these being for the purpose of retaining the heat. In from two to three or four hours the baking is finished, and, barring the "long pig," perhaps, a more healthful and toothsome method of preparing and cooking food, when superintended by an expert native Samoan *chef*, for example, could not, in the estimation of the writer, who has had opportunities for judging, be devised. The thought suggests itself here that the "clambakes" of our Atlantic States are a feeble imitation of this style of cooking among the islanders.

As wood or solid fuel of any kind is a most rare commodity on Rapa Nui the natives are compelled to use brush, twigs, and trash cast up on their island by the sea, anything, in fact, of an inflammable nature which they can pick up. They even economize the dried droppings of the cattle, as the Arab does those of his camel, for this purpose, and I saw great basketfuls of these carefully stowed away in their houses for future use.

They have no fixed time for eating, and while their *menu*, as may be

inferred from the statements contained in these pages, is never an elaborate one, it may readily be seen that they never suffer for lack of food of some sort, the principal items being sugar cane, taro, and sweet potatoes. Then, too, they are not heavy eaters, and gluttony with its attendent corpulency, so common in some of the other islands, is quite unknown here.

There are no fences or inclosures of any sort about their houses, which stand in the open field, with the grass growing to the doors, and nothing of an offensive nature was observable in the vicinity.

POPULATION, MANNERS, AND CUSTOMS.

It is difficult to obtain accurate information regarding the population of the island prior to the year 1860. That a numerous people must have existed here during the days of the image builders seems to be well attested by the works they have left behind them; the multitudes of colossal stone images and crowns; the numbers and vast size of the platforms on which these stood; the great paved areas beside them, which afforded room for large assemblages; the masses of foundation stones scattered over the island, many of which, still in position, show the strange shapes given to the houses which were erected upon them, and even admitting that these antiquities, and the work of fashioning them, covers a period of many years, the fact remains, nevertheless, that the immense labor involved, aided merely by the rude stone implements, which alone they were known to possess, must have necessitated the employment of a vast number of laborers. These, with their families, those engaged in the cultivation of the soil, in fishing and otherwise providing food, the aged and infirm, and those employed in other pursuits, must have made up an aggregate much larger than would at first sight appear.

With reference to the length of time covered by these works, it would seem, from the large number of images still to be seen on Rana Roraka, both inside the crater and on its outer slope—some finished, others only partly so, and others still in the quarries—that there was a large amount of work in process of execution at the same moment, and that, judging from the condition in which it was found, some sudden calamity must have overtaken the workmen, causing all labor to cease abruptly.

Indeed in respect to the astonishing number of volcanic stones so evenly scattered over the surface of the island, especially on the eastern half, it does not seem reasonable to suppose that they were there when the place was densely populated, of which latter circumstance there can scarcely be a doubt. This remark applies with especial force to the great plain at the foot and to the westward of Rana Roraka, where a large town is supposed to have existed, inhabited in part, it may be presumed, by the great numbers of workmen employed in the quarries of that mountain. Admitting this to be true and associating this with the fact that large numbers of the images seen in this vicinity are in

an unfinished condition: that many more are to be found in the quarries, both inside the crater and on its outer slope, in all stages of development: and inferring from this that the workmen suddenly ceased their labors, the thought readily suggests itself, in explanation of the mystery, that either Rana Roraka or one of the neighboring volcanoes suddenly entered into a state of activity, threw out these showers of stones and, probably destroying many lives, stopped the labors of the workmen, which were thenceforth never resumed. Perhaps, too, the same calamity overthrew many of the idols, of which not one is now standing on its pedestal, laid waste the island, and wrought the destruction of the trees which once adorned it, and from the period of the occurrence of that disaster, the time of which can only be remotely guessed at, dates the decadence of the ancient people of Te Pito te henua.

The soil of the island is very rich and productive, scant and unpromising as it may appear in many places, and with proper clearing and cultivation, and the planting of the appropriate varieties of food, such as could be stored for consumption during the dry season, supplemented by the sustenance to be derived from the supplies of fish taken, with which the waters abound, a very large population might, no doubt, be maintained.

As to the supply of water requisite for such a number of people, objection on that ground is not insuperable. Diligent search was made by the writer for the remains of cisterns, or any other evidences which they might have left of having had reservoirs for the storage of the precious fluid. None such were to be seen anywhere, and yet they might have possessed them, but of so perishable a character that all traces have long since been obliterated. It seems certain that they had no knowledge of any cement: it is not likely, therefore, that their reservoirs would have been built of stone. Then, too, there remains the fact of the immense bodies of water stored in these natural cisterns, the craters, particularly of Rana Kao. Here is a volume of water, at the present time at least 300 feet in depth, with a circumference at the surface of $2\frac{1}{2}$ miles, and, if the parts of the crater visible above the water line be extended downward, probably conical in shape. A moment's consideration will show that here is a supply of water sufficient for an almost unlimited number of beings for an indefinite period. It may easily be imagined, also, that measures were most likely taken to maintain its purity, and that a people as intelligent as they appear to have been had some device for obviating the labor of transportation to the top of the crater.

From what has been said it would appear that, even at the present day, the physical characteristics and natural conditions governing the island are not incompatible with the existence and well-being of a large population. I was not surprised, therefore, when Mr. Salmon informed me that from 1850 to 1860 the number of inhabitants was

estimated at 20,000, although other calculations give much smaller figures. I am of the opinion that in the days of the image and platform builders the population might have been even larger.

About the year 1863 the Peruvians carried off from the island in 15 vessels, as it is alleged, 5,000 of the inhabitants as agricultural laborers in Peru and to work the guano deposits of the Chincha Islands. By reason of the odium attached to this proceeding, the Peruvian Government, some time afterwards, was induced to return those who had not succumbed to their treatment and altered conditions of life. Smallpox broke out among these on the return voyage. It is stated that all except two died, and the disease, spreading among the people ashore, ravaged the island, many deaths resulting. Of those carried off by the Peruvians one old man, Pakomeo, who was taken to the Chinchas, and whom we saw, still survives, the last of the unfortunates.

Down to the year 1864 cannibalism is said to have been practiced by the natives. In that year a Jesuit mission was established on the island, at which time the population numbered about 1,500. Through the influence and teachings of the missionaries an almost radical change was wrought in the manners, habits, and character of the people, and, to a certain extent at least, they adopted the customs of civilized life.

When H. M. S. *Topaze* visited the island in 1868 there were but about 900 natives left, of whom less than 300 were females, with the numbers still rapidly declining, the proportion of deaths to births being given as 3 to 1. About the year 1875 some 500 were removed to Tahiti under contract to work on the sugar plantations of that island.

In the year 1878 the missionaries, who had done admirable work among them, departed from the island, taking with them about 300 of the people, who settled Gambier Archipelago.

When H. M. S. *Sappho* touched at the island in 1882 it was reported that but 150 of the inhabitants were left.

On the occasion of the *Mohican's* visit I received from Mr. Salmon, who had a complete census, with the names of every man, woman, and child on the island, the following summary:

Natives	155	
Foreigners	11	
Total number of inhabitants		166
Native men	68	
Native women	43	
Boys under 15 years of age	17	
Girls under 15 years of age	27	
Total number of natives		155
Tahitians	6	
English	2	
Americans	2	
Frenchmen	1	
Total number of foreigners		11

It will be seen from the above that, at the present time, among the children there is a preponderance of girls. The population is now reported at a standstill, the deaths and births about equaling each other in point of numbers. The average number of children to a family is given as three.

The age of puberty may be placed at 15 years in the male and 13 years in the female.

In color they are of a light brown, approaching here our lighter mulattos, the parts (face, neck, hands, etc.) exposed to the weather being always somewhat darker.

They have fine, jet-black hair, which may be wavy or straight (never "kinky"), and which is worn in variable styles, according to the taste of the owner, usually short among the men, and in plaits, down the back, among the women. They never decolorize it with lime nor trim it in any fanciful manner, as is the case in the Samoan Group and other South Sea islands. The beards of the men, which are never very heavy, correspond in these respects with the hair. There are several venerable looking gray-haired and gray-bearded old men among them. I saw no bald-headed ones, with a single exception. This was in the case of an old man who had been a cannibal, and, curiously enough, for generally throughout the islands they are very reticent on this subject, boasted of the number of human beings off whose flesh he had made a savory meal. When asked how he liked "long pig" he smacked his lips and expressed a regret that he could no longer enjoy the luxury. His expression and appearance were in keeping with his hideous appetite, for a more villainous-looking knave does not exist on the island.

The Rapa Nuiis may be considered a long-lived people. The oldest man and chief on the island, Mati by name, the patriarch of the Rapa Nuiis, does not know his actual age, but is certainly over 90 years old, and his wife, Maakua, of whom a photograph was taken, bears him close company in that as well as in other respects. The last king of the Rapa Nuiis, Maurata, also called Kaimokoe, was captured by the Peruvians, carried to the Chincha Islands, and died in 1864. His nearest descendant and successor, a nephew named Kaitae, is 79 years old. The last survivor of Peruvian captivity, Pakomeo, who was also photographed, must number at least the Biblical threescore and ten. These, with a few others not mentioned, may be considered a remarkable showing among so small a number of people, and proves not only that the original stock must have been a good one, but that their climate, surroundings, and mode of life were promotive of longevity.

In stature they are not a large race. There are a few, mainly among the older men, who are tall, erect, straight, spare in build, 6 feet or thereabouts in height, but the remainder, including the women, are smaller, and they may be classed as a small-boned, medium-sized people. They are not robust, apparently, neither are they very muscular; on the contrary, most of them present rather a slight, delicate, feeble appearance,

which is, however, misleading. They are wiry, lithe, strong, active, tireless on the march, capable of carrying heavy burdens long distances, indifferent to weariness, and seemingly equal to any amount of effort they might be induced to make. We saw this frequently exemplified on our tramp around the island, when, after a weary day's march, we would come into the camp foot-sore and tired, while they, fresh and active apparently, would go to work catching and dressing sheep, building fires, etc. If we complained that the water was "vai kava," bitter, they would endeavor to explain where better could be found and immediately start off, with bucket and canteen, on a tramp of a mile or two over the plain, or down into a crater, in order to bring us "vai maitai," good water.

These people proudly claim direct descent from the image and platform builders. It is not the writer's province to discuss this point, although strong arguments might be adduced to demonstrate the contrary. Be that as it may, it is very evident to the most casual observer either that the modern Rapa Nuiis belong, whether wholly or, which is more probable, in part, to a different race or that they are the "degenerate sons of worthy sires."

The color of their eyes is dark brown, with black brows and lashes, neither very heavy. Their expression of countenance is pleasing, mild, frank, modest, intelligent, and somewhat sad. They are slender but well formed, clean of limb, and the various parts of the body are well proportioned to each other. Their foreheads, while not very broad, are of good height and but slightly receding, which is also true of the facial angle generally. The head is well balanced and cheek bones are notably prominent. Their nose is quite straight and well shaped, with no marked spreading of the alae; mouths of moderate size and usually filled with excellent teeth, which, when the jaws are closed, come squarely into apposition; lips rather thin; hands and feet small. It may be mentioned that they attribute the beautiful appearance and excellent condition of their teeth to the chewing of sugar cane, large quantities of which they consume as food. There is nothing savage or repulsive looking about them, and some of their young women are decidedly comely and attractive. While in their habitations the evidences of good housewifery are nearly nil, they are quite cleanly in their personal habits and there is no unpleasant odor noticeable about their bodies. They all dress in European costume. They are a bright, intelligent, quick-witted people, of rather a nervous temperament; tractable and gentle in disposition, decidedly sympathetic and tenderhearted and markedly emotional in their natures, so that they are easily moved either to tears or laughter. In evidence of the latter trait in their character one or two instances may be adduced.

When the Catholic mission was first established on the island Chief Mati took a great liking to the reverend father in charge, evinced the greatest affection for him, and finally adopted him as his son. Such

being the case, it may readily be conceived that when the mission was removed from the island and the father was compelled to bid farewell to his simple-minded, but loving and faithful, Rapa Nui friend the parting must have been a sad and painful one. In the ten years which have elapsed since that time Chief Mati has never forgotten his well-beloved son, the priest, and whenever, which is only at very long intervals, a white man arrives at the island Mati's first thought is to inquire the tidings of his far-away friend. On the first occasion when my associate, Dr. Whitaker, in company with Mr. Salmon, who had previously advised the doctor on the subject, called on Mati, the latter, now over fourscore and ten, confident that the doctor came from the priest's country and must necessarily know him, immediately began to inquire regarding him; if he was well and happy; if he still loved and remembered him. When the doctor, in order to humor and gratify the old man, wove a harmless and ingenious, but fictitious, narrative about the priest, in which he highly commended Mati, the latter groaned dismally, contorted his face, and wept like a child. Seeing this, his poor old wife approached her husband, laid her arm on his shoulder, looked up in his face a moment, and then, after a series of mournful grimaces, bowed her head on her arm and, in the abandon of grief, groaned and cried aloud. Then everyone among the Rapa Nuis present, taking the cue from the old lady, lifted up their voices in chorus and for a time it fairly rained salt tears. The groans were dismal and the cries pitiful, so that the most callous might easily have been moved to compassion.

On another occasion the doctor was asked to see a little girl who was suffering with a cervical abscess. The usual crowd of men, women, and children was present. Had the doctor informed them in advance of what he intended doing they never would have consented to the proceeding. Quietly seating himself, he gently and unconcernedly drew the child toward him and, placing her head between his knees, drew from his pocket an abscess knife. That started the concert. The minute they saw it, and divined that he was going to cut the child, groans and lamentations and expressions of sympathy for the little one could be heard on all sides. Quickly incising the abscess the puss spurted and ran in a stream, whereupon the audience howled with renewed energy, curiosity having produced a temporary lull, and for a time the situation was interesting and entertaining to a degree. The child, who had scarcely felt the blade, and scared by the din about her, must needs pipe her little tune and join with the others. As soon as they saw that the child had not been harmed and understood the object of the apparent cruelty their demonstrations were just as pronounced in the other direction and they manifested their delight and gratification in expressions of joy, and peals of hysterical laughter, and were prepared to mount the doctor on a platform, so to speak, then and there.

As with all the natives throughout the South Sea islands, the Rapa Nui is undeniably, and very decidedly, averse to hard work. He delights

to lie around and gossip, to smoke, to sit and "moon" over the industry, the greatness, and the monuments of his ancestors, the degeneracy and decadence of his race, perhaps, and his own utter and ineradicable worthlessness individually. Natural covetousness and desire for the possession of lucre may tempt him to serve the white man for a time, but he soon tires of his work, which speedily becomes irksome to him. And while he may exert himself a trifle occasionally, in the way of fishing, or in the cultivation of an 8 by 10 patch of sugar cane, taro, and sweet potato, it is only as a matter of necessity, to keep body and soul together, and he infinitely prefers idleness and the enjoyment of his *dolce far niente.*

Intoxicating drinks of any description, even kava, so common in the islands to the westward, are unknown to these people, and neither do Mr. Salmon, or the other foreign residents, keep any liquors in their possession. While, therefore, it is true that here, as elsewhere among uncivilized peoples, contact with the European has been attended by their gradual extinction, it can not be said that all the usual factors obtain in this instance, since neither the venereal poison nor intoxicants exist on the island. Consequently, these can not be assigned as causes of the decadence of the Rapa Nuiis. Deportation, forced and voluntary, smallpox, and customs, elsewhere mentioned in this paper, will explain their gradual extinction, in part, at least, while the fact remains that their seemingly inevitable destiny was vastly accelerated when the white man set foot upon their mysterious, mid-ocean island.

The rite of circumcision, so common in the other islands, is unknown here, nor does their language possess an equivalent word.

As may be inferred from the preponderance of the male over the female portion of the community the latter are in demand, and the supply not being equal to it, the women are a source of great solicitude; much consideration is shown them; they are fairly well taken care of, and are treated, generally, with kindness, not to say affection. Polygamy, under the circumstances, does not, of course, exist and celibacy, it may be said, only from necessity, since there are not enough females.

While it can not be truthfully claimed that polyandry, in the strict acceptation of the term, obtains among them, they have a custom which very nearly approaches that practice, as will appear presently.

At the present day the ceremonies of the church, measurably at least, govern their marriages; nevertheless the ancient custom still prevails, to a considerable extent, and in a few words it is this: When a boy arrives at the age of, say 12 years, his father looks about him for a suitable life-companion, of the opposite sex, for the young hopeful. Having discovered one to his liking the father proceeds to interview the parents of the damsel, who is perhaps of the same age, or more likely younger than her prospective lord, declares his intentions matrimonial and negotiations are then entered into. After a due amount of haggling as to the value of the girl, during which the parents of the

latter endeavor to "bull" the market, while those of the boy do their utmost to "bear" the commodity under appraisement, the price is finally agreed upon and the bargain is concluded, the consideration being a specified quantity of sugar cane, taro, sweet potatoes, chickens, etc., to be paid the girl's parents. A day is then fixed upon; relatives and friends are notified; due preparations are made at the girl's house, to which the articles mentioned have meanwhile been sent, and at the time appointed, all interested being present, a grand feast is held, at which, as a rule, everything edible, that is to say the price of the girl, is consumed. That important business being finished, bride and groom retire to the residence of the parents of the latter, by whom the bride is adopted as their own child, and thenceforth the parties are husband and wife.

The cares and the obligations of matrimony, as well as of parentage, sit lightly upon the Rapa Nuiis. Although marital infidelity may be rare, it is stated that a husband will, in consideration of a certain quantity of produce, make over all right in his wife to another for a specified period, at the expiration of which time he will take back the wife and she again becomes the partner of his joys and sorrows. This might be called polygamy in another form.

Fixing the average at three gives, I think, a very fair estimate of the number of children to a family, and the lack of fecundity among them will readily be explained by the early child marriages, customs, habits of life, intermarriage, and the degeneracy of the race.

In these people the lower part of the body and extremities were found well developed, and in the women more so than would be supposed from their slight physique. In the latter the skin was lighter in color in the unexposed than in the exposed parts. The hips are broad and full, the thighs large, round, and firm, and legs straight and tapering to the ankles, which, with the feet, were small and delicate. They are but sparingly hirsute. The breasts of those examined were moderately large, full, round, firm, and carried well up on the chest. The nipples were quite small, but with good-sized areola, which latter presented, in some instances, that peculiar puffy, translucent appearance, as though filled with serum, often seen throughout the other Pacific Islands. The Rapa Nuiis differed from these in that the areola was not so large nor of so deep a tint, the writer having seen them in other islands covering half the breast and nearly black in color.

The skin of the woman examined, where not covered with tattooing, was nearly as light in color as that of the average brunette, and very fine, smooth, soft, and delicate.

There seems to be no doubt that, with all their apparent mildness and good nature, the baser passions and savage instincts of these people are strong within them, and instances of inhumanity occasionally crop out among them. A case which came under the notice of Dr. Whitaker was that of a woman who was suffering from spinal deformity, the result

of injuries inflicted by her husband in a moment of blind rage over some grievance, fancied or real. In this connection it may be mentioned that subsequently this same woman went to nurse Pakomeo, previously mentioned, who was ill at the time. Upon the recovery, so well pleased were they with each other that she abandoned her cruel spouse, remained with Pakomeo, was living with him as his wife at the time of our visit, and the arrangement seemed mutually satisfactory.

The custom of tattooing has fallen off within the last few years and is now rarely or never practiced. It is only among the adults, more especially among the older people, that good examples may be found. Unless the inhabitants of other islands, where a standard pattern is adhered to, the Rapa Nuiis seem to have affected no uniform fashion nor limited themselves to any particular style. The custom obtained alike among the male and female members of the community. Generally speaking, the ornamentation was as follows: A narrow band around the upper part of the forehead, at the edge of the roots of the hair, with little balls, each joined to the band by a stem, pendant from it, the whole simulating a coronet; a line around the outer free edge, the helix, and lobe of the ear; a line around the edge of the lips; the neck in its entire circumference, either in straight lines, vertical or oblique, or with the lines wavy; three radiating exclamation marks beneath each ear, common among women at the present day; a girdle about the waist, in broad bands, with an attempt at lace work, or fringe, from which rise heavy lines, at the ends of which, toward the axillæ, are fanciful figures resembling faces, with a larger face in the middle of the back; fine lines down the thighs anteriorly; heavy, undulating bands posteriorly, running over the buttocks toward the waist; wavy or straight perpendicular lines, terminating in points, around the legs, and elsewhere.

The material used in tattooing is made of the soot obtained by burning a plant with a leaf similar to our Indian corn, and called by the natives *ti*, moistened with the expressed juice of a berry similar to our pokeberry, and called *poporo*. Pieces of bone, finished like a fine-toothed comb, or fish bones made fast to a short stick, are used to prick the skin by holding in contact with the surface and striking it a brisk blow.

Before the advent of the missionaries the Rapa Nuiis possessed scant wardrobes. They made a coarse cloth woven of the fibers of the inner bark of the *mahuti*, Chinese paper mulberry, or of the *burau*, another fibrous tree, which they wore about the shoulders and loins. This cloth was also used, in the manner of a shield, as a protection in battle against the enemy's spears, which latter was, with the exception of the war club, their principal weapon, the head being made of obsidian, numbers of which may be found on the island. They also made siapu, or tapa, as do the natives of other islands, by beating out the bark and wearing the same as a breechcloth. With the coming of the missionaries civilized clothing was introduced and is now generally worn, comprising coat, shirt and trousers, among the men, and a loose gown of cotton mate-

rial, printed or plain, for the women. Shoes are worn on only special occasions of ceremony, as, for example, during our visit. On their heads both sexes alike wear hats, the material of which is either bulrushes or long, slender leaves, torn into narrow strips, braided and then sewn together spirally. In making these they are far behind other islanders, the Tahitians more especially, attributable mainly, however, to the want of proper material rather than to the lack of intelligence.

Crimes of any sort, but especially the graver ones, are of great rarity, and murder, at the present day, unknown. Petty thieving is common, is considered a venial offense, and the injured party seeks redress by stealing in kind, if possible, but in any event, stealing from the thief. There are no punishments, so called. Mr. Salmon, who is guide, philosopher, and friend to these people, unites in his person (and being a giant in stature, he can well contain them) the duties of referee, arbiter, judge. They entertain the greatest respect for him: evince the utmost affection; look up to him as their master; go to him with all their troubles; refer to him all their disputes and grievances. His word is law, and his decisions final and undisputed.

There is a schoolhouse in which the people are taught from books translated into Rapa Nui language by the priests formerly here, and most of the natives can read and write. The functions of pedagogue are performed, after a fashion, by Pakomeo, the survivor of the Peruvian captives, who is also a preacher among them and conducts the services at the little church. The form of salutation on meeting is kohomai, "come to me." The reply, koe, which means "thou," you, yourself. In Tahiti, Society Islands, and Rarotonga it is, Ia-ora-na, "may you live in God." In the Samoan group, kalofa, "love to you" and tofa, "may you sleep."

With regard to the burial rites, it may be stated that no particular respect is shown persons of rank while living; still less do they receive any special funeral ceremonies when dead. All are treated alike in this regard, on the principle, presumably, that death levels all. The period of mourning extends over three days, and the rites are simple enough. Nowadays the service of the church is usually invoked. The body is carried out of the house and removed to some distance, either in the open plain, or to one of the image platforms, or into a cave, where it is exposed to sun and air (incidentally, it may be mentioned, also to predatory rats and cats in a semiwild state, which roam the island in large numbers, the former especially) until either dry, decomposed, or partially devoured. In the caves the remains are then shoved into an out-of-the-way corner and walled in with loose stones. At the platforms they may be laid away under a gigantic prostrate stone image, or placed in an excavation, either in the face or floor of the platform, or simply put in a convenient spot and covered up with stones. On the plains a circular conical cairn, truncated at top, 6 to 8 feet high, and built of loose bowlders, is frequently erected over the remains. Often the bones

of several individuals may be found in one receptacle, and at one of the platforms a collection of skulls alone was discovered in a sepulcher which was opened.

The rats, which by reason of the loose manner of interment have free access to the remains, no doubt perform an important office as scavengers in disposing of the soft parts, since in no single instance were any bones found, either human or sheep—and the skeletons of both were frequently fallen in with—which were not completely denuded, and the fine litter, which was almost invariably found in the cranial cavity, showed where the rodents had been nest-hiding.

The food of the Rapa Nuiis comprises the following principal articles: Sugar cane, taro, sweet potatoes, bananas, fowl, shell and other fish in large quantities, tomatoes, pumpkins, figs, pigs, and rarely sheep and cattle.

Their manner of cultivating the soil is of the simplest description. Owing to the depredations of the numberless sheep and cattle, they are compelled to keep all their cultivated patches carefully inclosed, and as there is no wood on the island which can be applied to that purpose they are forced to use volcanic stones. Occasionally, therefore, one may see a wall about 2 feet thick by 6 or 8 feet high inclosing a plot of ground perhaps 50 feet square, in which will be found a variety of the plants above mentioned growing luxuriantly.

The average Rapa Nuiis, however, perhaps wisely, prefers a fence ready made to building one himself, and therefore selects the standing stone walls of one or more of the old houses, which he appropriates to his purpose. There are many of these scattered over the island, particularly on the eastern half. These require but little repair to put them in order and secure against the entrance of sheep, and, although small, they amply suffice to supply the needs of the native husbandmen. Of course there is no pretense of cultivation; the ground is scratched; the article planted; the rest is intrusted to the care of the omnipotent *atua*.

The soil is rich, and ancient navigators report the island covered with vegetation, and yet one could not repress the feeling of surprise, in view of the present unpromising appearance of the surface and unfavorable surroundings, on seeing how vigorously and luxuriantly everything grew within these inclosures.

LANGUAGE OF THE RAPA NUIIS.

NAMES OF ANIMALS.

Sheep	mamoi.
Horse	hoi.
Cattle	puaka.
Sow	oru tamahine.
Boar	oru tamaroa.
Hen	cufa.
Eel	koiro.
Black sea bass	kodoti.

Three other kinds of fish found in waters around island .... mahori. maito. mahaki.
Limpet (*Chiton magnificus*)..................hemama (used as food).
Small univalve...................................ngingongi (used as food).
Land crab.......................................pikea.
Portuguese man-of-war (*Physalia utricules*)....papaki (used as food).

NUMERALS.

1. Ka tahi.
2. Ka rua.
3. Ka toru.
4. Ka ha.
5. Ka rima.
6. Ka ono.
7. Ka hitu.
8. Ka varu.
9. Ka iva.
0. Aanghuru.
10. Ka tahi te aanghuru.
11. Ka tahi te aanghuru ka tahi.
12. Ka tahi te aanghuru ka rui.
13. Ka tahi te aanghuru ka toru.
14. Ka tahi te aanghuru ka ha.
15. Ka tahi te aanghuru ka rima.

* * * *

20. Ka ruate aanghuru.
21. Ka ruate aanghuru ka tahi.
22. Ka ruate aanghuru ka rua.
23. Ka ruate aanghuru ka toru.
24. Ka ruate aanghuru ka ha.

* * * *

30. Ka toru te aanghuru.
31. Ka toru te aanghuru ka tahi.
32. Ka toru te aanghuru ka rua.
33. Ka toru te aanghuru ka toru.

* * * *

40. Ka ha te aanghuru.
41. Ka ha te aanghuru ka tahi.
42. Ka ha te aanghuru ka rua.

* * * *

50. Ka rima te aanghuru.
51. Ka rima te aanghuru ka tahi.

* * *

60. Ka ono te aanghuru.
70. Ka hitu te aanghuru.
80. Ka varu te aanghuru.
90. Ka ira te aanghuru.
100. Ka rau te aanghuru.
101. Ka tahi te rau ma tahi.
102. Ka tahi te rau mā rua.

200. Ka rua te rau.
201. Ka rua te rau ma tahi.

300. Ka toru te rau.
301. Ka toru te rau ma tahi.

500. Ka rima te rau.

1,000. Piere.
2,000. Ka rua te piere.
3,000. Ka toru te piere.
4,000. Ka ha te piere.

10,000. Ka mano.
100,000. Ka peka.
1,000,000. Ha ra.

* * * *

Over one millión: Mingoi-ngoi.

NAMES OF PARTS OF HUMAN BODY.

Abdomen..........manava.
Ankle..............kari-kari vae.
Anus...............kaufa.
Arm.................rima.
Artery.............ua noho toto.
Back...............tua ivi.
Beard..............vere.
Bladder............taua mimi.
Blood..............toto.
Bone...............ivi.
Breath.............hangu.
Buttock............eve taki eve.
Calf of leg........reru.
Chest..............uma.
Chin...............kauae.
Ear.................taringa.
Elbow..............twii rima.
Eye (or face)......mata.
Eyebrow............hihi.
Eyelash............veki-veki.
Eyelid.............tutu-mata.
Face (or eye)......mata.
Fat.................nako.
Finger.............manga-manga.
Finger, index......rima tuhi henua.
Finger, middle.....roaroa ta hanga.

Finger, ring	rima tuhi a hana.
Finger, little	ko maniri ko manara.
Foot	vae.
Forearm	paonga.
Forehead	korae.
Hair	rauoho.
Hand	rima (hence 5).
Head	puoko.
Heart	mokoikoi.
Hip	tipi.
Instep	peka-peka vae.
Intestines	nene-nene.
Kidney	makoikoi.
Knee	turi.
Leg	heru.
Lips	ngutu.
Liver	ate.
Lung	inanga.
Mamma	u.
Mustache	vere ngutu.
Mouth	haha.
Muscle	kiko ua-ua.
Nail	mai-kuku.
Navel	pito.
Neck	ngao.
Nipple	mata u (eye of trout).
Nose	ihu.
Nostril	poko-poko ihu.
Palm	pararaha rima.
Pancreas	kiko o te ivi tika.
Perineum	vaha takituu.
Pubes	puku.
Pulse	ua naiei.
Pupil	arioko tutu.
Rib	kava-kava.
Scalp	kiri puoko.
Shin	paka.
Shoulder	kapu hivi.
Skin	kiri.
Sole of foot	pararaha vae-kiri vae.
Spine	tua papa.
Spleen	para.
Stomach	kopu mau.
Tendon	ua-ua.
Thigh	papa-kona.
Thumb	rima metua nea-nea.
Toe	manga-manga vae.
Toe, great	manga-manga tumu.
Tongue	arero.
Tooth	niho.
Vein	ua.
Waist	kakari manava.
Wrist	kokau rima.

NAMES OF SOME OF THE RAPA NUI PLANTS.

Sea-weed	miritonu.
Kelp	harepepe.
Ice-plant	herepo (used as food).
Lichen	kihi-kihi.
Gourd-vine	hue.
Bulrush	naatu.
Grass, native (bunch)	moku.
Milk-thistle	poporo-hiva.
Hard-wood tree	toromiro (for making idols).
Paper-mulberry, Chinese	mahuti.
Ash, variety of	marikuru.
Ferns	kava-kava atua. nehe-nehe. riku.
Plantain	kohe.
Bastard sandalwood	nau-nau.
Marshmallow	mova.
Convolvulus, pink	tanoa.
Leek (?), edible	heke-koehe.
Brier, bearing sweet-smelling flower	ngaoho.
Plant with purple flower similar to lavender	matahini.
Plant with pink, star-shaped flowers, like verbena; about 1 foot high; growing over entire island; brought from Chile and used as tea by natives; in eruptions	raau.

Comparison of the Rapa-Nui names of thirteen common English terms with the corresponding words applied to them in the languages of other islands in the Pacific Ocean and Malay Archipelago and the Malayan Peninsula.

English.	Rapa-Nui.	Rarotonga.	Saparua.	Ceram.	Amboyna.	South Celebes.	Malay.
Fish	Ika	Ika	Ian	Ikan	Iyan	Ikani	Ikan.
Bird	Manu	Manu	Mano	Manok	Mano	Manu	Burong.
Eye	Mata	Mata	Mata	Mata	Mata	Mata	Mata.
Ear	Taringa	Taringa	Terena	Terina	Terina	Talinga	Telinga.
Hand	Rima	Rima	Rimah	Limamo	Rimak	Lima	Tangan.
Foot	Vae	Vai	Ai	Ai	Ai	Oei	Kaki.
Nail (finger)	Mai-kuku	....	Teri	Wuku	Kuku	Kuku	Kuku.
Tooth	Niho	Nio	Nio	Nisomo	Niki	Nichi Gigi	Gigi.
Fire	Ahi	Ai	Hao	Aif	Aou	Api	Api
Water	Vai	Vai	Wai	Wai	Weyr	Auer	Ayer.
Man	Tangata	Tangata	Tumata	Tumata	Maloira	Tau	Orang laki laki.
Boat	Vaka	Vaka	Tala	Waha	Haka	Sakae	Prau.
Cocoanut	Niu	Niu	Muollo	Nua	Nier	Nyoroh	Klapa.

THE MAN'S KNIFE AMONG THE NORTH AMERICAN INDIANS.

A STUDY IN THE COLLECTIONS OF THE U. S. NATIONAL MUSEUM.

BY

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INTRODUCTION.

Among implements used by man, the same forms may sometimes be employed for destruction and at other times for industrial purposes. When used for destruction they are weapons, but when their function is industrial they are tools. The same object, when used as a weapon, becomes a dagger, but if it be employed as an edged tool it is a knife. As in the case of all other weapons or tools, the edged tool works by pressure, by friction, or by a blow. One used by means of a blow is an ax if the edge is in a line with the handle, and an adz if it lies across the handle; an edged tool working by friction is a scraper, but one working by pressure is a knife.

It will be found in the study of industrial knives that in the long run they become the carver's and engraver's tools, the drawing knife, the spokeshave, the plane, and the planing mill. In some styles of the last named, however, the operative part of the machine is, more properly speaking, a machine adz than a knife. Carving in wood and other substances by the American aborigines differentiated the adz from the knife. It is probable that before the introduction of iron into America the adz was used more than the knife in dressing down wood; but when the iron blade came into vogue it was possible for the savage workman to carve out hollow dishes and boxes, and other objects with his knife by simple pressure. Notable exceptions to this are those regions where soft wood came into alliance with sharks' teeth and the incisors of rodents. This is shown in all the curved knives of the collections in the U. S. National Museum from the two hemispheres, especially those from wooded areas.

IMPROVEMENT THROUGH THE CURVED KNIFE.

There ought to be no doubt that in every case where the savage was fortunate enough to obtain the knife his carving and whittling were better done. There is a marvelous difference between carving on the one hand, man's work chiefly, and basketry or pottery on the other, conservative woman's work. In no tribes were the two last-named arts bettered by contact with the higher race. The work was done with the hands almost wholly. The tools were of the simplest character. The harsh iron awl was not so good as the smooth pointed bone awl, of which hundreds have been found, and the pride in personal endeavor departed with the quenching of the tribal spirit. The potter's wheel, such as it was three centuries ago, was only a barrier to the unmechanical sex. Therefore those who constantly assert that prejudice made it impossible for the savage to better himself in the adoption of the white man's devices catch only half a truth.

CLASSIFICATION.

In the class of cutting tools called knives, there are in the U. S. National Museum, collected among the North American Indians, two series. One has been called the "woman's knife;" the other, therefore, may now be denominated the "man's knife."[1]

Both of these series exist aboriginally in two subdivisions, the one containing no iron or evidences of the use of that metal, the other made partly of iron or with iron. In fact, there are four subdivisions of the term "industrial knife," namely, woman's knife, ancient; woman's knife, modern; man's knife, ancient; man's knife, modern.

The man's knife of the modern type exists in three varieties, to wit, the "curved knife," with bent blade, employed usually in whittling; a second variety, named "straight blade," with a short straight cutting part used in carving stone, antler, ivory, and other hard substances; and a third variety, usually with an old knife blade or piece of file well worn down for its working part, employed in the function of a burin for scratching or etching on hard surfaces. The three varieties necessarily merge into one another, so that there are no broad dividing lines. The curved knife may now be carefully examined as a contribution to studying the man's knife of ancient type.

PARTS OF THE CURVED KNIFE.

Each variety of man's curved knife, as of other primitive and modern mechanics' tools, consists of three elements or parts, differing among the several tribes and from place to place in materials and forms, though the blades furnished by Europeans are of the same general motive.

First, the whittling blade is usually of iron or steel, beveled on the

[1] The Ulu, or Woman's Knife, Rept. U. S. Nat. Mus., 1890, pp. 411-416, plates 52-72.

upper side and plain on the under side, and more or less curved upward at the outer end. The blades of commerce are not greatly different in shape, but it will be seen that native ingenuity has been able to fashion blades from any piece of iron. Murdoch, speaking of Point Barrow, says that "the carver's knife is not always curved in the blade."[1]

Those that are sold to the natives are mostly curved, and the handles are added afterwards. Example Cat. No. 89291 in the U. S. National Museum from Point Barrow has a short, thick "jackknife" blade much worn down. It is hafted between two longitudinal sections of reindeer antler held together by rivets, one section being cut out to receive the tang. Two rivets are of iron and three of brass.

The tang of the blade, which exists as an element in the hafting, is usually a continuation thereof, without much finish, being a flat rectangle in outline. The form of the tang, however, will be governed by the method of its application to the handle, as will appear. It may be, first, pointed and driven into the end of the handle; second, rectangular and laid between the halves of the handle; third, set into a narrow groove on top of the handle; fourth, laid in a shallow groove on the side of the handle: fifth, set in a saw-cut in the end of the handle.

Second, the handle or grip. This may be either of wood taken from the forest or from wreckage, or of bone or antler. The woman's knife, usually, has the grip attached to the back of the blade along its extent and the blade in position is under the grip. But in the man's knife the end of the blade forms the tang and the place of attachment for the handle, and therefore the grip is cylindrical or partly so. In point of fact the handle may be said to have three parts—the pommel or butt, quite frequently ornamented, even in tools of savages; the grip or portion actually in the hand, and the joint or hinge. The form of the grip may be that of the natural piece of material. Woman's knife handles are much more delicately fashioned to fit the fingers than are those of the man's knife. But in the curved type the thumb is especially cared for, as giving leverage and guidance in whittling, and in some examples a long extension of the handle enables the whittler to call into activity every muscle of his forearm. The portion of the handle and the treatment of it with reference to the bond or connection with the blade will be spoken of in the next paragraph. The modifications of the handle for the insertion of the working part involve the selection of the grain, splitting one end, splitting the handle, drilling, grooving, sawing, socketing, etc.

Third, the bond or "connective" between the blade and the grip—that is, between the working part and the manual part. In the history of tools these connective devices have had an interesting elaboration. Practically, the bond between working part and manual part consists of three elements: First, a modification in the blade corresponding to the tang; second, a modification of the handle for the insertion of the

[1] John Murdoch, Ninth Annual Report of the Bureau of Ethnology, p. 155, fig. 110.

tang; and third, the true connective of packing, cement, lashing, rivets, wedges or screws, some of which appear in the illustrations of this paper. Where the tang is driven into the end of the grip the elasticity or cohesion of the material forms the bond. In many examples the principle of the ratchet and of the dovetail exist in the shaping of the tang and its socket or in cutting notches on the tang.

Before the introduction of the Iron Age into North America there existed the same elements in the composition of a knife, to wit, a blade of tooth, or shell, or stone; a handle of antler, bone, or wood; and a connective of rawhide, sinew, yarn, or twine, of packing, of cement, and possibly of rivets made of wood, bone, ivory, or antler.

MODE OF CUTTING.

All primitive men's knives with single edge, so far as the national collections indicate, are made to cut toward the operator. Double-edged knives, however, cut both ways. Among the American examples all are for the right hand or for both hands. Lawson distinctly says that "when the Carolina Indians cut with a knife, the edge is toward them, whereas we always cut and whittle from us; nor did I ever see one of them left-handed."[1] The farrier, as will be seen, also cuts toward him, but by turning his hand under, in an awkward sort of way, occasionally cuts from him. Two curved knives in the U. S. National Museum from the Ainos of northern Japan, constructed exactly after the manner of the American curved knives, are made to fit the left hand, but they were received from the same person. It will be perfectly plain to one who has sharpened a quill pen or lead pencil that, in the absence of spoke shaves and fine carver's tools, the Indian was compelled to cut toward his body.

SOURCE OF CURVED KNIFE.

This manner of working is, doubtless, a survival of old processes of hand work before the introduction of more modern tools. It may have been overlooked by the student of technology that it was not until recently that any care was bestowed upon fitting the handles of mechanics' tools to the hand itself. In the case of the woman's knife it will be found that the farther away the Eskimo live from the white race the more simple the handle of the scraper, while in those areas where the contact has been most intimate the handle is more completely and perfectly made to conform to the right hand.

It is astonishing that until Perry's visit to Japan the handles of all Japanese tools were extremely simple. There are some specimens of bronze implements found in Europe in which the handle conforms to the right hand of the worker. It is reasonably certain, therefore, that the man's knife and the farrier's knife have come down from a remote past in their present simple form.

[1] The History of Carolina, Preface, p. v, Raleigh, N. C., 1860 [reprint], p. 330.

It is not disputed that among American Indians all of the iron-bladed knives for men are exotics, at least in the working part or blade. Ethnographers will notice also that in the acculturation of savages it is always the working part that they are willing to improve without prejudice. The manual part holds its own longer, and it will be seen that the grip and connective of men's knives are often "old school" while the blade is "new school."

An important question arises as to the date of introduction and the exact European source of some of the forms of blades. The only survival in the United States of the curved blade is in the farrier's knife, with which he pares the hoof of the horse prior to laying on the shoe. After a diligent search among cutlers it is difficult to ascertain how long this form of knife has been in use among farriers, and what its precise relation is to the North American curved knife.

Murdoch draws attention to the fact that the Eskimo of Point Barrow call all knives savik, meaning also iron, the identical word used in Greenland for the same objects.[1] From this he argues that the first iron was obtained from the East, along with the soapstone lamps instead of from Siberia, as was tobacco. It is true, however, that whittling with a curved knife having a thumb cavity prevails all over eastern Asia. The white migrants to Greenland antedated those to Alaska, nevertheless, by several centuries. It will be found, also, by examining the Eskimo knives of Murdoch and Nelson, that they often differ radically from the Indian types here especially noted. Seldom does an Indian knife show the presence of the blacksmith, while the whaleship's blacksmith seems to have been a successful schoolmaster to the Eskimo. Moreover, ivory, antler, and bone are far less tractable than birch saplings for whittling, or cedar for shaping, excavating, or carving. The Eskimo blade is shorter, straighter and never used with two hands, while the Indian knife is used for grooving and reducing large surfaces in the absence of the plane.

Among North American aborigines the iron-bladed knife is restricted in its area to the Eskimo and the Indian tribes southward in Alaska, the Dominion of Canada, and the splint basket, snowshoe, the self-bow, and the birch-bark canoe area of the United States. The last-named implements are jackknives par excellence. They are designed for whittling and producing shavings, and not for chopping or scraping—that is, the formation of chips across the grain or of sawdust and scraps. These lines must not be too sharply drawn, however, inasmuch as this paper is restricted to materials furnished by the collections in Washington. It is wonderful how adept primitive artisans are in getting a variety of work out of one implement. In the absence of spokeshaves, planes, chisels, gouges, groove planes, small adzes, and a host of others, the Pacific coast Indians do the work of all with a double-edged curved blade $\frac{1}{2}$ inch wide and 3 inches long.

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[1] John Murdoch, Ninth Annual Report of the Bureau of Ethnology, p. 157.

Within the regions mentioned there is for the student an excellent opportunity to study the effect, materials, and their environmental forces upon the construction of the knife. Two varieties of the man's knife are steadily used by the Eskimo—the carver's knife and the etching knife or burin; but, all other shapes are employed by them, so that one finds the curved knife for whittling, the straight blade for carving, and the pointed blade for etching. The blades are short and firmly attached to the handles by rivets or by lashing. The handles are usually of bone, antler, or ivory, some of them being curved to fit the forearm and give great purchase in cutting hard material; others are short and adapted to be grasped in the hand for the purpose of making small chips and even for scraping.

The Canadian Indians and those of the northern United States, having only soft material and bark to work upon, restrict themselves mostly to the long-bladed curved knife. On the Pacific coast, among Indian tribes from Mount St. Elias and southward, there is a mixture of hard material and soft wood, so that there is a great variety in the form of the whittler's knife. Furthermore, these tribes have been in contact with sailors for more than a century and use any piece of steel or iron they can secure in trade. The Canadian Indians were stimulated by the fur-trading companies to travel more rapidly and to make longer journeys; hence, in furnishing them with the curved knife, they made it possible for these Indians to work out the frame of the birch-bark canoe, the bows of the snowshoes, splints for basketry, and a thousand and one objects made of birch bark, with this simple but most efficient device. It has become the traveling tool of the Canadian Indians and has done more than aught else to improve their mechanical skill. An examination of old patterns of snowshoes, in comparison with the latest patterns, reveals an astonishing improvement. The versatile curved knife is just as useful in the making of fine babiche or rawhide string for the webbing of the snowshoe as in whittling down the frame. In the old-fashioned snowshoes the rawhide footing is nearly one-fourth inch wide, while in the best and latest the strands are as fine as thread.

EXAMPLES.

Example Cat. No. 176434, in the U. S. National Museum, is a farrier's knife (fig. 1), made and used by M. E. Horigan, horseshoer in Washington, D. C. The blade is a wedge-shape piece of steel, flat on the lower side and beveled on the upper side, and bent to a hook at the other end. The tang is in form of a rectangle 2 inches long. The handle is a piece of a rib from an ox; the natural curve is taken advantage of in the manufacture; a slight notch is cut on the upper end for the thumb, and depressions have been worn on the upper face by the fingers of the operator. In order to combine the blade with the handle, a saw cut is made on the inner end of the latter for 2 inches. The tang is slipped into the saw cut and is held firmly in place by

two rivets passing through both it and the handle. Many thousands of specimens as rude as this are in use among the horseshoers all over the United States and Canada.

Example Cat. No. 153603, in the U. S. National Museum, is a curved knife from the Micmac Indians of Nova Scotia (fig. 2), collected by Dr. G. M. West. It has the usual farrier's blade let into a narrow notch or stub groove on the back of the handle and held by a seizing of cord. The handle of hard wood fits the hand of the workman very neatly.

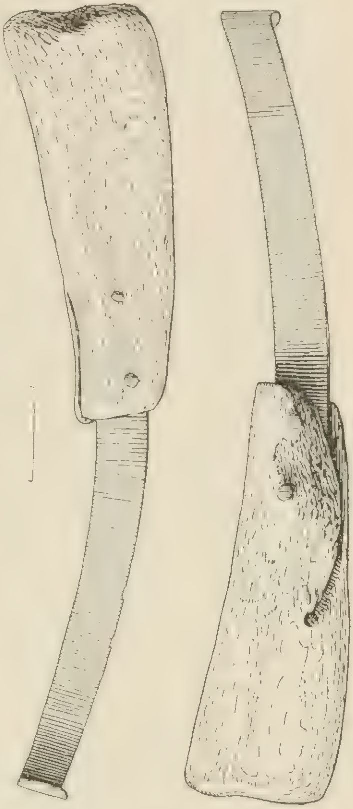


Fig. 1.
FARRIER'S KNIFE.
Back and front views.
Washington, D. C.
Cat. No. 176434, U.S.N.M.

In this example, as in others, the seizing or connective, holding the blade and the handle together, is easily removed so as to allow the former to be taken out and sharpened. Especial attention is called to the fact that, in accordance with northern usage, the end of this cord is driven into the handle and held fast by means of a wooden peg instead of being fastened off by being tucked under one of the former roundings itself. Length, 9¼ inches.

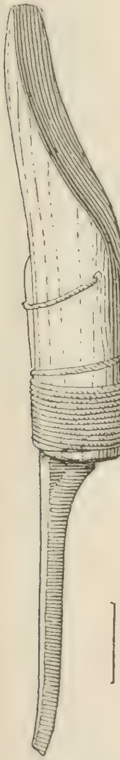


Fig. 2.
MICMAC CURVED KNIFE.
Cat. No. 153603, U.S.N.M.

Example Cat. No. 153604, in the U. S. National Museum, is a curved knife also from the Micmac Indians of Nova Scotia (fig. 3), collected by Dr. G. M. West. The blade is of European manufacture, slightly curved, let into a groove on top of the handle and neatly seized with a thong of rawhide. At one end the thong is doubled over the tang and driven into the groove of the handle; the other end is drawn through a hole bored in the handle, wedged fast and cut off, making a very neat finish. The handle is made of birch wood and curved to fit the hand, the bevel for the thumb being unusually long and broad. Length, 10½ inches.

The Micmacs are especially whittlers in bow staves, snowshoes, and canoe frames. The women also make splint baskets in wickerwork. Their household utensils were in wickerwork and birch bark, so they did little adzing.

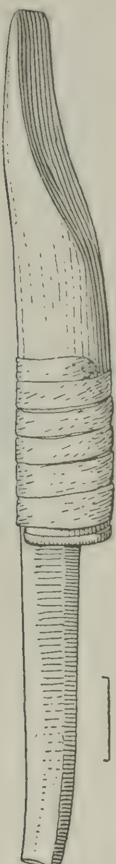


Fig. 3.

MICMAC CURVED KNIFE.

Cat. No. 153604, U.S.N.M.

Example Cat. No. 54338, in the U. S. National Museum, is a curved knife from the Passamaquoddy Indians, Eastport, Maine (fig. 4), collected by Mr. R. Edward Earll. The blade is in form of a farrier's knife, let into a stub groove on the back of the handle, and held in place by a seizing of wood splint. The handle is straight in the grip, and turned up and beveled at the outer end to receive and fit the thumb, as in other curved knives. The connective of wood splint is specially noteworthy in its neat administration and thoroughly aboriginal fastening off, as in the two previous specimens from the Micmac Indians. Length, 10½ inches.

Mr. Lucien Turner says of the Nenenot Indians of the Algonquan stock, living on the borders of the Ungava, in northern Labrador, "that they make their crooked knives of steel files and knife blades (fig. 5). The Indian reduces the metal to the shape desired, flat on one side and beveled on the other, by grinding. He then heats the blade and gives it the proper curve." He also draws attention to the fact that left-handed persons suit the tool to their hand by bending the blade in the proper direction. "No Labrador Indian ever goes on a journey without a curved knife. The handle is held at right angles to the body and drawn toward the user. It is employed in all cases for whittling or shaving wood and the preparation of the strips and slats of canoes, paddles, snowshoes, and everything cut from wood. It requires great skill to use the knife properly."

Fig. 4.

PASSAMAQUODDY KNIFE.

Cat. No. 54338, U.S.N.M.

Turner says that "this tool is in universal use both among the Eskimo and the Indians of this region."

Example Cat. No. 153498, in the U. S. National Museum, is a curved knife from Labrador (fig. 6), collected by Dr. H. G. Bryant. The blade

is like that of the farrier's knife. The shank is let into a stub groove on the side of the handle; a thin portion of the piece of wood taken out is restored and a seizing of tawed buckskin is wrapped around. The handle is rectangular and terminated with a curved portion to fit the thumb. The noticeable feature of this knife is that the shank of the blade is let into the handle in such way that when cutting is being done the strain comes against the solid wood and not against the buckskin lashing, as in a great many examples studied. Whittling does not involve hard pressure, so there is no necessity for a strong joint, as in the knives for carving hard substances.

Fig. 5.

CURVED KNIFE FROM UNGAVA.

Cat. No. 10657, U.S.N.M.

Example Cat. No. 153046, in the U. S. National Museum, is a curved knife from the Nascopi Indians of Labrador (fig. 7), collected by Mr. Charles McLaren. The blade is inserted into a stub groove in the top of the handle, and this is covered by a strip of wood, and all lashed together with a rawhide band, which is fastened off by tucking under at both ends. The handle is of spruce wood, and the grip is straight, but the thumb portion is bent up and inward so as to fit exactly the curvature of the hand. A loop of string at the outer end of the handle completes the device. Especial attention is called to the neat fastening of the rawhide connective. Length, 9 inches.

Fig. 6.

CURVED KNIFE FROM MONTAGNAIS INDIANS.

Labrador.

Cat. No. [illegible], U.S.N.M.

In the annual report of the Bureau of Ethnology, Dr. W. J. Hoffman figures a curved knife in general use among the Menomini Indians in Wisconsin. These Indians are of the Algonquian stock, and one is not surprised, therefore, to find a curved knife of the same type as those of eastern Canada and the United States. The handle has a long slope for the thumb; the tang of the blade is let into a stub groove on the side of the handle and at the tip end carried quite through. The connective portion of the handle is also cut in a long groove to secure the cord used in lashing. The author says that "among the Menominis this knife is used in preparing the splints from elm logs, out of which baskets are made."

The cutting is always done toward the body. In the case of these knives it will be seen that the function of splitting, planing, and smoothing is performed rather than that of excavating and finishing off large blocks of soft wood.

Fig. 7.
CURVED KNIFE FROM NASCOPI INDIANS.
Cat. No. 153046, U.S.N.M.

The material employed by the Menominis in their basketry is tough, and therefore only soft saplings are used in their work.[1]

Holm figures a large number of men's carving knives.[2] Seven of his figures give bone or antler handles, four have plain wooden handles, and in two of them bone and wood are mixed. Seven of these have blades of stone and seven have iron blades. The preciousness of iron is shown in blades made up of two or three pieces or strips of iron riveted together. The blades are all inserted into the ends of the handles, most of them by driving. Two show evidences of saw-cuts at the ends and three have wrappings or bands of twine. The only ornamentation on these handles are rings and geometric figures made of dots. Four of the bone handles are shaped somewhat into characteristic forms.

Parry says that "the principal tool of the Eskimo of Iglulik was the knife (panna); that they possessed a great number of excellent ones previously to his coming, and that the work was remarkably coarse and clumsy. The manner of holding the the knife also was most awkward; that is, with the edge backward."[3]

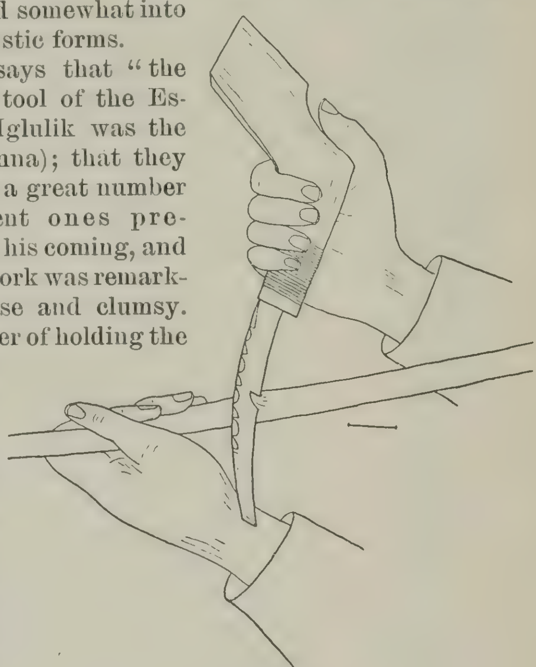


Fig. 8.
ESKIMO KNIFE.
Mackenzie River.
Cat. No. 1100, U.S.N.M.

Example Cat. No. 1100, in the U. S. National Museum, is a curved knife from Anderson River, in the Mackenzie River district (fig. 8), collected by Mr. R. M. Macfarlane. The blade is much curved, let into a stub groove on the top of the handle, and

[1] Fourteenth Annual Report of the Bureau of Ethnology, p. 260; also Harper's Magazine, March, 1896, p. 505.
[2] Holm, Ethnologisk Skizze, Copenhagen, 1887, plate 18.
[3] Parry's Second Voyage, London, 1824, p. 536.

held by a seizing of fine rawhide thong. One end of the thong is driven into the groove end of the handle, a favorite method of fastening off among the Eskimo. The other end is fastened off by simply drawing it through a dozen turns of the seizing. There are no knots tied. The handle is of fine spruce wood in the shape of a knee, and chamfered on the back to fit the thumb. This is an unusual shape among handles. Length of blade, 5 inches.

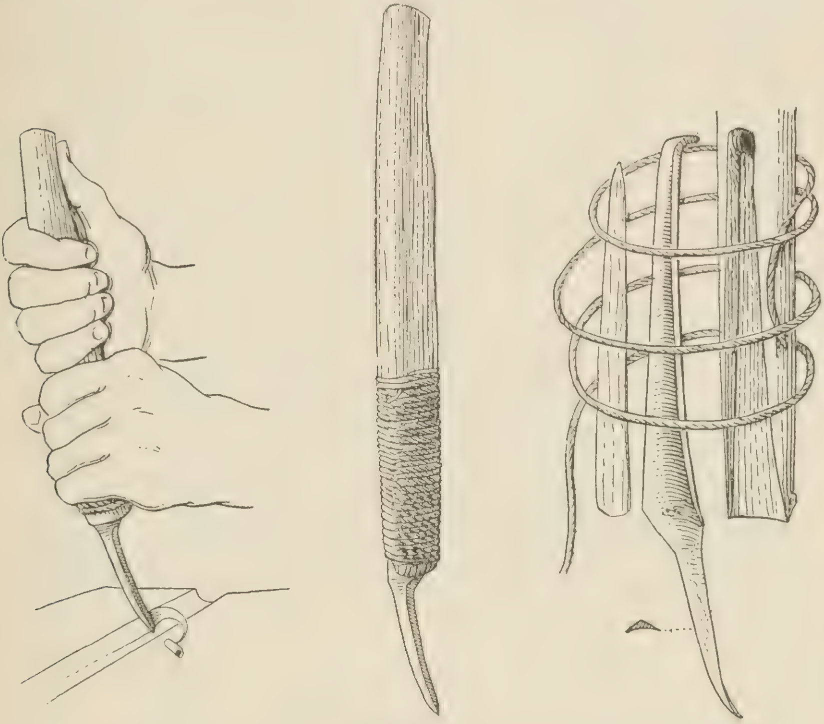


Fig. 9.

TWO-HANDED CURVED KNIFE, SHOWING STRUCTURE AND METHOD OF USING.

Yakutat, Alaska.

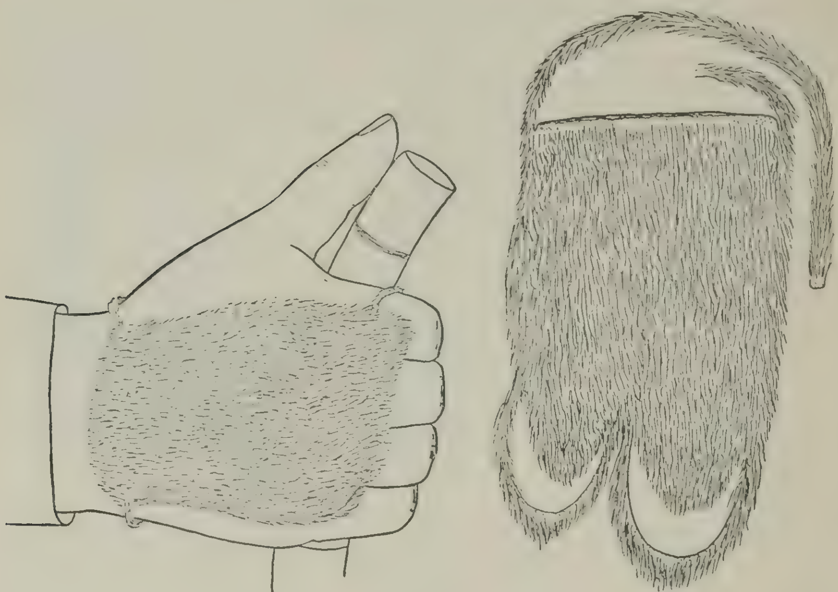
Cat. No. 178196, U.S.N.M.

Murdoch declares that the Point Barrow Eskimo have two styles or sizes of carver's knives, one large Midlin, with a haft 10 to 20 inches long, for wood working, and a small one, Savigron (instrument for shaving), with a haft 6 to 7 inches long, for working bone and ivory. The knife is held close to the blade between the index and second fingers of the right hand, with the thumb over the edge, which is toward the workman. Murdoch speaks in great praise of the skill of the carver.[1]

[1] Ninth Annual Report of the Bureau of Ethnology, p. 157, fig. 113.

It is easy to understand the existence of the two types in the arctic area, where soft driftwood exists alongside of antler and ivory.

Example Cat. No. 20831, in the U. S. National Museum, is a curved knife from Prince of Wales Island, Alaska, collected by Mr. James G. Swan. The curved blade is of iron, with both edges alike, and resembles the modern can-opener. To form the joint its tang is roughly let into the wooden handle at its end on one side, the other side being notched, and is held in place by a lashing of thong. The handle of oak is curved upward outside the thumb space and



Figs. 10, 11.

CARVER'S KNIFE, AND GUARD FOR BACK OF HAND.

Sitka, Alaska.

Cat. Nos. 168342, 168345, U.S.N.M.

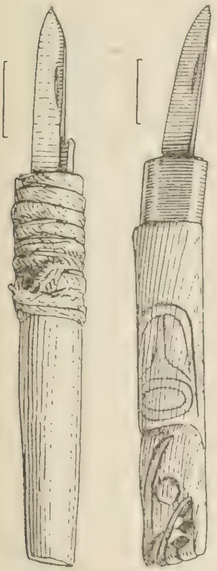
tapers slightly to the outer end. The noteworthy features are the adaptation of a modern can-opener for the blade, the resemblance of the handle with its thumb space to Japanese and Korean handles, and the notch at the inner end to prevent the slipping of the seizing. Mr. D. W. Prentiss, jr., of the U. S. National Museum, had the good fortune to observe a Yakutat Indian carving with a large specimen of this variety of two-edged blade (Cat. No. 178196, U.S.N.M.). The handle is held in both hands while the carver dresses down the inside of his canoe or wooden box. Now chipping toward himself, now away, with the greatest rapidity, he gave the fine adz finish often observed

on many objects brought from the cedar areas of southeast Alaska. In this its perfected form the knife is both chisel and adz, working always by pressure (fig. 9).

Example Cat. No. 168342, in the U. S. National Museum, is a curved knife from the Tlingit Indians of Alaska (fig. 10), collected by Lieut. G. T. Emmons, U. S. N. It consists of a blade of a common pocketknife driven into the end of a handle of antler and held in place by an iron ferrule and by a seizing of rawhide thong. The handle has rings scratched around it an inch apart. The example has this peculiarity, that the bevel of the blade is underneath, for the workman to cut toward him, and must have been designed, therefore, to be used after the modern fashion of a trimming chisel. Length, $7\frac{1}{4}$ inches. With this knife belongs example Cat. No. 168345, U.S.N.M., a guard of sealskin to be worn on the back of the hand (fig. 11), so that when the workman is whittling in a box or canoe he may protect himself. The entire outfit is quite modern, but it is remarkable that this guard is the only example of its kind in the collection.

Fig. 12.
CARVER'S KNIFE, FOR TWO HANDS.
Sitka, Alaska.
Cat. No. 20752, U.S.N.M.

Example Cat. No. 20752, in the U. S. National Museum, is a curved knife from Sitka, Alaska (fig. 12), collected by Mr. James G. Swan. It is evidently made up for trade, and shows no sign of use, but it has the long handle of the Yakutat two-handed type. The blade, with two edges, is lashed by its tang to the side of a pine handle by means of a buckskin thong, which last is the only aboriginal part of the apparatus, and is laid on in a slovenly manner, and any savage would be ashamed to use it on his own account.



Figs. 13 14.
CARVER'S KNIVES.
British Columbia.
Cat. Nos. 129976, 129978, U.S.N.M.

Since ethnographic material has entered into commerce the Museum curator is vexed continually by receiving specimens that never had any serious aboriginal use. Furthermore, trade centers, such as Unalaska, Sitka, Victoria, and Honolulu, where in the old days whalers met and exchanged or pawned their collections from different places, specimens were carried far from their original source, and now can be identified only by comparing them with well-authenticated objects.

Example Cat. No. 129976, in the U. S. National Museum, is a wood carver's knife from the Kwakiutl Indians of Fort Rupert, British Columbia (fig. 13), collected by Mr. James G. Swan, and forms a transition between old art and European art. The blade is that of a modern jackknife set into the end of an oak handle and held firm by a ferrule of sheet brass nailed on. Here are united in a single joint the most primitive and most persistent connective, namely, a tang driven into the grain of the handle at the working end and metal ferrule, the latest form of bond. The handle is slightly curved, and bears on its end and surface a carving of a totemic animal's head and fins. Length, 8½ inches.

Fig. 15.
CURVED KNIFE.
Fort Rupert Indians.
Cat. No. 129977, U.S.N.M.

Example Cat. No. 129978, in the U. S. National Museum, is a similar knife, with jackknife blade in a very plain handle without carving (fig. 14). To form the joint the inner end of the handle has a saw-cut made across, into which the tang of the blade is set and made fast by a wire driven through the hinge hole. Stovepipe wire is wrapped about the joint, and a wedge of wood and one of iron driven in between the edges of the tang and the wire. Outside the wire is a wrapping of cotton rag to protect the hand. This example shows that there is plasticity even in the savage mind. The elements of this old form have been nearly all patented inventions.

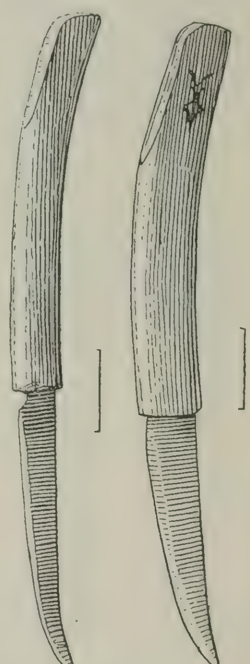


Fig. 16.
CARVER'S KNIVES.
From the Ainos.
Cat. No. 150715, U.S.N.M.

Example Cat. No. 129977, in the U. S. National Museum, is a curved knife of the Fort Rupert or Kwakiutl Indians (fig. 15), collected by Mr. James G. Swan. It consists of a blade bent up at the top, beveled only on the upper side, and by its shank lashed to a shouldered cut on the handle. The handle is of oak and is also curved. The two parts are held together by a seizing of twine, and outside of this a wrapping of blue cloth. Length of handle, 8 inches.

Example Cat. No. 150715, in the U. S. National Museum, is a curved knife of the Ainos of Yezo (fig. 16), collected by Mr. R. Hitchcock. The tang of the blade of iron is driven into a wooden handle, which is

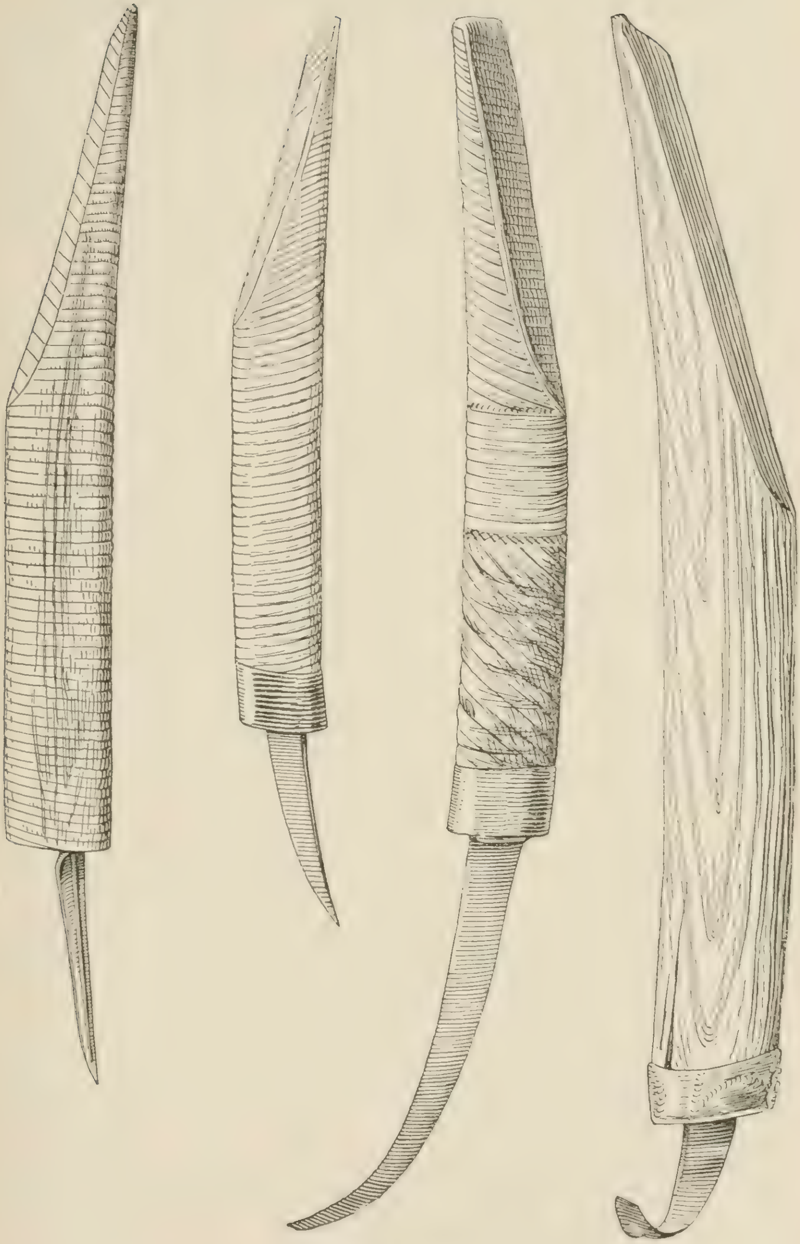


Fig. 17.

CURVED KNIVES.

Amoor region.

After von Schrenck.

slightly curved and has a chamfer for the thumb. There is no attempt at cementing or seizing or ratcheting on the tang. The bond is in effect a very ancient connective done in iron. Length. 7½ inches.

Example Cat. No. 150715 (*a*), in the U. S. National Museum, is similar to the foregoing excepting that the blade is straight and there is a slight carving at the outer end of the handle. The handle in both of these specimens seems to be left hand, inasmuch as the bevel and curve of the blade and the chamfer fit the left hand and do not fit the right. The great number of whittling knives of this species in eastern Asia raises some interesting questions of the method of intrusion of the Iron Age into the aboriginal life of the Western World.

In the area between Bering Strait and the Aleutian Islands, under the influence of Russian traders and the whaling industry, great numbers of carver's knives in endless variety are found. The largest collection from this region has been made by Mr. E. W. Nelson, and the forms of whittling knives, carving knives, and etching knives will be found fully illustrated in Mr. Nelson's work.

A large and interesting series of curved knives were collected by von Schrenck about the mouth of the Amoor River and northward, and are now in the Imperial Museum at Moscow. These knives represent all of the different classes spoken of in this paper, to wit: Knives with straight blades, for ordinary domestic purposes; those with long curve, for ordinary whittling; those with abrupt curve at the end, as in the farrier's knife, for excavating canoes and boxes; and those with sharp points, for engraving on hard substances. The handles are either plain or ornamented and have a short or a long bevel for the thumb. Those which have a decided sidewise curve are always fitted to the right hand and cut toward the person (fig. 17).

CONCLUSION.

I find that in the employment of the curved knife the Eskimo, the Canadian tribes, together with their kindred on the northern boundary of the United States, and, more than all, the North Pacific tribes on both sides of the ocean have exhausted the possibilities of an implement that has been in the hands of some only a century or two.

The arts of all these tribes were bettered and not degraded by the curved knife. In every case they were immensely improved. The form of knife with straight, short blade made it possible for the northern and western tribes to become better carvers and engravers. Before the possession of iron there is meager evidence that either of these areas possessed other than the most trivial carvings in hard material. Their best results were in soft wood and slate, by means of beaver tooth or shark's tooth knives.

The curved knife serves to confirm the opinion that as soon as any process or device came within the scope of a people's intelligence they have mastered it and brought it to a climax, from which time on new ideas and new inventions replaced the old.

List of man's knives in the U. S. National Museum.

Cat. No.	Curved knives.	Locality.	Collector's name.
481	Iron knife (small)		
834		Fort Good Hope, N. W. Territory.	R. Kennicott.
1100		do do	R. Macfarlane
1307-9	Eskimo knives	Anderson River do	C. P. Gaudet.
1635	Eskimo knife	do do	R. Macfarlane.
1643	do	Mackenzie River do	Do.
1646	Man's knife	Anderson River do	Do.
1649	do	do do	Do.
1675	Man's curved knife	do do	Do.
2094	Carver's knife	do do	Do.
2101-4	Eskimo curved knives	do do	Do.
2274-75	Long-handled curved knives	do do	R. Kennicott.
2276-77	do	do do	R. Macfarlane.
2278-93	Short curved knives	do do	Do.
2297	Carver's knife	do do	Do.
2304	do	do do	Do.
2308	do	do do	Do.
5121	Eskimo knife	Mackenzie River do	Do.
5813	Small knife	Anderson River do	Do.
7405-10	Eskimo knives	Mackenzie River do	Do.
7455-61	Small iron knives	do do	Do.
10194	Man's knife	Igloolik, Baffin Land	C. F. Hall.
16146	Carver's tool (graver)	Cape Etolin, Nunivak Island, Alaska.	W. H. Dall.
16163	Carver's knife	do	Do.
16172	do	do	Do.
18920	Iron knife, bone handle	Clallam Indians, Washington.	J. G. Swan.
20458	Bone knife	Santa Barbara, California	Paul Schumacher.
20752-53	Curved knives	Tlingit, Sitka, Alaska	J. G. Swan.
20831	Iron curved knife and sheath	Hannegah, Charlotte Island.	Do.
20846	do	Kootznoo Indians, Alaska	Do.
24411	Bone or ivory knife, iron blade.	Norton Sound, Alaska	L. M. Turner.
30107	Small table knife	Cumberland Gulf, Baffin Land.	W. A. Mintzer, U. S. N.
32145-46	Bone knives	Point Townsend, Washington.	J. G. Swan.
32874-84	Man's knives, bone or wood handle.	St. Michaels, Alaska	E. W. Nelson.
33027-28	Curved knives	Nulato do	Do.
33030	Knife for carving ivory	Nulato Ingalik do	Do.
33304	do	St. Michaels do	Do.
33314	Handle of wood-working knife.	Pastolik do	Do.
36315	Knife, ivory handle, iron blade.	Sfugunugumut do	Do.
36316	do	Kongigunogumut do	Do.
36507	Knife, bone handle, metal blade.	Koolwoguwigumut do	Do.
37326-28	Knife handles	Kushunuk do	Do.
37420-25	Ivory carved knife	Anogogumut do	Do.
37440		Ukogumut do	Do.
38113	Carved knife	Newlukhtulugumut do	Do.

List of man's knives in the U. S. National Museum.

Cat. No.	Curved knives.	Locality.	Collector's name.
38486	Carver's knife	Lower Yukon, Alaska	E. W. Nelson.
38487	do	do ... do	Do.
43407	do	Cape Prince of Wales ... do	Do.
43873	do	Unalakleet ... do	Do.
44757	Handle for working knife	Sledge Island ... do	Do.
45488	Curved knife	St. Michaels ... do	Do.
46080-81	Knife for carving	Port Clarence ... do	W. H. Dall.
46303	Curved knife	do ... do	T. H. Bean.
48085	Woodworking knife	Cape Darby ... do	E. W. Nelson.
48087	Ivory and bone worker	do ... do	Do.
48291	Wood curved knife	Nunivak Island ... do	Do.
48536	do	Kotzebue Sound ... do	Do.
48846-47	Knives for splitting birch bark.	Mission, Lower Yukon ... do	Do.
48916	Finger guard against curved knife.	Sabotnisky ... do	Do.
54338	Curved knife	Eastport, Maine	R. E. Earll.
55923	Carver's tool (graver)	Bristol Bay, Alaska	Chas. L. McKay.
55942-43	Woodworking knives	do ... do	Do.
56546	Man's knife, iron blade	Point Barrow ... do	Lieut. P. H. Ray.
56552-54	Curved knife	do ... do	Do.
60188-92	Curved knives, bone and wood handle.	Kootznahoo ... do	J. J. McLean.
63274-75	Knives for carving ivory, etc	St. Lawrence Island ... do	E. W. Nelson.
63316-22	do	do ... do	Do.
63541-42	Iron knife blades, curved, unfinished	do ... do	Do.
64154-55	Curved knives, leather sheath	Hotham Inlet ... do	Do.
67978	Curved knife for wood carving.	Tlingit, Sitka ... do	J. J. McLean.
76702	Curved knife	Fort Alexander, Alaska	J. H. Johnson.
89271-83	Knives, iron blades	Point Barrow ... do	Lieut. P. H. Ray.
89293-304	Knives for carving	do ... do	Do.
89383-84	Knives, iron blades	do ... do	Do.
89579	Slate knife, bone handle	do ... do	Do.
89582	Slate knife, wooden handle	do ... do	Do.
89586	Slate knife, bone handle	do ... do	Do.
89587-95	Bone handle knives	do ... do	Do.
89597	Single-edged slate knife	do ... do	John Murdoch.
89633-41	Knives, flint blade	do ... do	Lieut. P. H. Ray.
89644	Crooked knife	do ... do	Do.
89652	Small knife	do ... do	Do.
89653	Carver's knife (graver)	do ... do	Do.
89821	Knife, iron blade	do ... do	Do.
89964-66	Knives for carving	Labrador	L. M. Turner.
90210-11	do	Ungava Bay, Labrador	Do.
90458	Knife, wood carving	Ugashik, Alaska	William J. Fisher.
126629	Iron knife blade	Tonalan, Mexico	Dr. E. Palmer.
127461	Curved knife	Iguswek River, Alaska	I. Applegate.
127567	Knife (el curvo)	Chile	W. E. Curtis.
127649	Curved knife	Ft. Alexander, Alaska	—— Johnson.
127788	Carving tool	Nakneek ... do	William J. Fisher.
127809	Curved knife	Kauchiung ... do	Do.
127895	Knives	Putnam River, Alaska	Lieut. Geo. M. Stoney, U.S.N.

List of man's knives in the U. S. National Museum.

Cat. No.	Curved knives.	Locality.	Collector's name.
129976-78	Curved knife	Kwakiutl, Fort Rupert, Alaska.	J. G. Swan.
130470	....do	Godthaab, Greenland	Theo. Holm.
131220	Knife, glass blade	Borja Bay, Patagonia	Thomas Lee.
150715	Curved knife, left handed (?)	Aino, Yezo, Japan	R. Hitchcock.
153046	Curved knife	Naskopies, Labrador	Dr. W. J. Hoffman.
153498	Curved knife, pine handle	Montagnais, Labrador	H. G. Bryant.
153603-4	Curved knife	Micmacs, Nova Scotia	Gerald M. West.
166956	Knife for carving	Yukon River, Alaska	J. H. Turner.
168342	Carving knife	Tlingit, Sitka, Alaska	Lieutenant Emmons.
176434	Farrier's knife	Washington City	M. E. Horrigan.

CLASSIFICATION OF THE MINERAL COLLECTIONS IN THE U. S. NATIONAL MUSEUM.

BY

WIRT TASSIN,

Assistant Curator, Division of Mineralogy.

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PREFACE.

This outline is preliminary to an exhaustive descriptive catalogue, and is issued in response to numerous requests for methods of classification, arrangement, etc.

The series is divided into two general classes—native elements and compounds of the elements. The compounds of the elements are further divided and grouped under certain heads according to, and which take their names from, their more negative constituents as follows: Compounds of the halogens, fluorides, chlorides, bromides, and iodides. Compounds of sulphur, selenium, and tellurium; also arsenic and antimony, including sulphides, selenides, and tellurides; arsenides, antimonides, sulpharsenides, and sulphantimonides; also sulphosalts. Oxygen compounds, including oxides and the oxygen salts, borates, aluminates, chromites, ferrites, manganites, plumbates, arsenites and antimonites, selenites and tellurites, carbonates, silicates, titanates, columbates and tantalates, nitrates, vanadates, phosphates, arsenates and antimonates, sulphates, selenates and tellurates, chromates, molybdates and tungstates, iodates, and uranates. Compounds of organic origin, including salts of organic acids and carbon compounds.

Each of these classes is further separated into groups, the minerals included in any one group being such as are related in the details of chemical composition. Each of these groups is preceded by a general group label giving the class to which it belongs, the group name, the minerals composing that group, together with their chemical composition, system of crystallization, and a short description of the occurrence, association, and characteristic form of each member of the group. The following label will serve to give a clearer idea of this arrangement:

Tungstates.

Wolframite Group.

Wolframite.	$(Fe,Mn)WO_4$	Monoclinic.
Hübnerite.	$MnWO_4$	Monoclinic.

Wolframite.—Chiefly ferrous tungstate, with some manganese. It occurs in irregular lamellar, coarse divergent columnar, and granular masses, and in crystals, commonly tabular. Color and streak nearly black. Wolframite is often associated with tin ores, and with quartz carrying bismuth, scheelite, pyrite, galena, sphalerite, etc.

Hübnerite.—Chiefly manganese tungstate, with some iron. It occurs in bladed forms and massive in quartz, and with alabandite, rhodonite, scheelite, fluorite, and apatite. Color brownish red, hair brown to nearly black. Streak yellowish brown.

Following the group label, arranged in order from left to right, are the several members of the group, selected to illustrate as completely as possible their occurrences, associations, and variety in form and color. Each specimen is mounted upon a block, in front of which is a small label giving the name of the species, the minerals associated with it in that particular specimen, if any, its locality, catalogue number, and from whom and how received.

The several groups are placed in regular order in the cases, and each case carries a case label giving the name of the class to which its contents are referred. In the upper left-hand corner of each case is a numeral followed by an arrow, which serves to indicate the sequence in which the cases are to be studied, and also to facilitate reference to the text of a descriptive catalogue to be printed.

CLASSIFICATION.

I. ELEMENTS.

Of the seventy or more elements at present known to chemistry but eighteen, excluding those occurring only in the gaseous state, are found native. With the native elements are included the native alloys, or compounds and mixtures of elements belonging to the same groups in the periodic system.

Group 1.

Diamond.	C.	Isometric; tetrahedral.
Bort.		
Carbonado.		
Graphite.	C.	Hexagonal; rhombohedral.
Schungite.		
Graphitoid.		
Cliftonite.		

Group 2.

Sulphur.	S.	Orthorhombic.
Selen sulphur.	(Se,S).	
Tellur sulphur.	(Te,S).	
Selenium.	Se.	
Tellurium.	Te.	Hexagonal; rhombohedral.
Selentellurium.		

Group 3.

Arsenic.	As.	Hexagonal; rhombohedral.
Arsenolamprite.		
Allemontite.	(As,Sb).	Hexagonal; rhombohedral.
Antimony.	Sb.	Hexagonal; rhombohedral.
Bismuth.	Bi.	Hexagonal; rhombohedral.

Group 4

Tin.	Sn.	
Lead.	Pb.	Isometric.

Group 5.

Iron.	Fe.	Isometric.
Catarinite.	Fe_2Ni	
Octibbehite.	Fe_2Ni_3	
Awaruite.	Fe_2Ni_4	
Josephinite.	Fe_2Ni_5	

Group 6.

Platinum.	Pt.	Isometric.
Platiridium.		
Iridium.	Ir.	Isometric.
Iridosmine.	(Ir,Os).	Hexagonal; rhombohedral.
Sysserskite.		
Osmiridium.	(Os,Ir,Pt,Rh)	Hexagonal; rhombohedral.
Newjanskite.		
Palladium.	Pd.	Isometric.
Allopalladium.	Pd.	Hexagonal; rhombohedral.

Group 7.

Mercury.	Hg.	
Amalgam.	Ag_2Hg_3 to $Ag_{36}Hg$.	Isometric.
Copper.	Cu.	Isometric.
Silver.	Ag.	Isometric.
Gold.	Au.	Isometric.
Electrum.	(Au,Ag,Hg).	
Porpezite.	(Au,Pd).	
Rhodite.	(Au,Rh).	

II. COMPOUNDS OF THE ELEMENTS.

The great majority of minerals are compounds of elements. By a compound is meant that body produced by the combination of two or more elements, and which is different in its nature from and whose properties as a rule are not the mean of those of its constituents. A compound is to be distinguished from a mixture or simple mechanical aggregation in that it always implies a chemical union of its components, and therefore possesses a definite chemical composition.

Among minerals the compounds of the elements may be arranged, in accordance with certain chemical laws, under the following heads: A. Compounds of the halogens—fluorine, chlorine, bromine, and iodine. B. Compounds of sulphur, selenium, and tellurium; also arsenic, antimony, bismuth, and germanium. C. Oxygen compounds. D. Compounds of organic origin.

A. COMPOUNDS OF THE HALOGENS—FLUORINE, CHLORINE, BROMINE, AND IODINE.

The halogens—fluorine, chlorine, bromine, and iodine—form simple and complex compounds with other elements. The halides, as these

compounds are called, are derivatives of HF, HCl, HBr, and HI, and are divided chemically into four classes—fluorides, chlorides, bromides, and iodides—according to the nature of the negative constituent. Two of the halogens—fluorine and chlorine—enter into the composition of several oxidized compounds, called oxyfluorides and oxychlorides—compounds in which there is a metallic fluoride or chloride with a basic oxide of the same metal.

CLASS,—FLUORIDES.

Group 1.

Fluorite.	CaF_2.	Isometric.
Sellaite.	MgF_2.	Tetragonal.

Group 2.

Tysonite.	$(Ce,La,Di)F_3$.	Hexagonal.

Group 3.

Cryolite.	Na_3AlF_6.	Monoclinic.
Elpasolite.		
Chiolite.	$Na_5Al_3F_{14}$.	Tetragonal.

Group 4.

Hieratite.	K_2SiF_6.	Isometric.
Cryptohalite.	$(NH_4)_2SiF_6$.	Isometric.

Group 5.

Prosopite.	$CaAl_2(F,OH)_8$.	Monoclinic.

Group 6.

Hydrous Fluorides.

Fluellite.	$AlF_3.H_2O$.	Orthorhombic.
Pachnolite. } Thomsenolite. }	$NaCaAlF_6.H_2O$.	Monoclinic.
Hagemannite.		
Gearksutite.	$CaF_2.Al(F,OH)_3.H_2O$.	(?)
Ralstonite.	$(Mg,Na_2)F_2.Al_3(F,OH)_9.2H_2O$.	Isometric.
Yttrocerite.	$[(Y,Er,Ce)F^3.Ca_5F_{10}].H_2O$.	(?)

CLASS,—CHLORIDES, BROMIDES, AND IODIDES.

Group 1.

Chloromagnesite.	$MgCl_2$.	(?)
Hydrophilite.	$CaCl_2$.	Isometric.
Scacchite.	$MnCl_2$.	(?)
Lawrencite.	$FeCl_2$.	(?)
Cotunnite.	$PbCl_2$.	Orthorhombic.

Group 2.

Molysite.	$FeCl_3$.	Hexagonal.

Group 3.

Nantokite.	Cu_2Cl_2.	Isometric.
Marshite.	Cu_2I_2.	Isometric (?)
Calomel.	Hg_2Cl_2.	Tetragonal.

Group 4.

Halite.	NaCl.	Isometric.
Rock salt.	(Na,K)Cl.	
Sylvite.	KCl.	Isometric.
Sal-Ammoniac.	NH_4Cl.	Isometric.
Cerargyrite.	AgCl.	Isometric.
Huantajayite.	(Ag,Na)Cl.	
Embolite.	Ag(Cl,Br).	Isometric.
Bromyrite.	AgBr.	Isometric.
Iodobromite.	Ag(Cl,Br,I).	Isometric.
Miersite.	AgI.	Isometric.
Iodyrite.	AgI.	Hexagonal.
Cuproiodargyrite.	(Ag,Cu)I.	(?)

Group 5.

Pseudocotunnite.	PbK_2Cl_4.	(?)

Group 6.

Hydrous Compounds.

Bischofite.	$MgCl_2.6H_2O$.	(?)
Erythrochalcite.[1]		
Chloralluminite.	$AlCl_3.xH_2O$.	(?)
Carnallite.	$KMgCl_3.6H_2O$.	Orthorhombic.
Erythrosiderite.	$K_2FeCl_5.H_2O$.	Orthorhombic.
Kremersite.	$(NH_4,K)_2FeCl_5.H_2O$.	Isometric.
Douglasite.	$K_2FeCl_4.2H_2O$.	Monoclinic.
Tachhydrite.	$Mg_2CaCl_6.12H_2O$.	Hexagonal; rhombohedral.

CLASS,—OXYFLUORIDES AND OXYCHLORIDES.

Group 1.

Nocerite.	$(Mg,Ca)_3OF_4$.	Hexagonal.

Group 2.

Fluocerite.	$(Ce,La,Di)_2OF_4$.	Hexagonal.

Group 3.

Matlockite.	Pb_2OCl_2.	Tetragonal.
Mendipite.	$Pb_3O_2Cl_2$.	Orthorhombic.
Daviesite.		
Schwartzembergite.	$Pb_3O_2(Cl,I)_2$.	Hexagonal; rhombohedral.
Penfieldite.	Pb_3OCl_4.	Hexagonal.

Group 4.

Laurionite.	PbOHCl.	Orthorhombic.
Fiedlerite.		
Percylite.	$PbCu(OH)_2Cl_2$.	Tetragonal.
Cumengite.		
Boléite.		
Atacamite.	$Cu_2(OH)_3Cl_2$.	Orthorhombic.
Sarawakite.[2]	Antimony oxychloride.	(?)
Daubréeite.[2]	Bismuth oxychloride.	(?)

[1] Erythrochalcite is a hydrated copper chloride which may perhaps belong here.

[2] These compounds are of uncertain composition and may perhaps belong in this group.

Group 5.

Atelite.	$Cu_3(OH)_4Cl_2.H_2O$.	(?)
Tallingite.	$Cu_5(OH)_8Cl_2.4H_2O$.	(?)
Footeite.	$Cu_9(OH)_{16}Cl_2.4H_2O$.	Monoclinic.

B. COMPOUNDS OF SULPHUR, SELENIUM, AND TELLURIUM; ALSO ARSENIC, ANTIMONY, AND BISMUTH.

This division includes the non oxidized compounds of sulphur, selenium, and tellurium; also arsenic, antimony, and bismuth. It embraces the sulphides, selenides, and tellurides of the elements; also the arsenides, antimonides, and bismuthides, the sulpharsenides, sulphantimonides, and sulphbismuthides, and the sulphosalts.

SULPHIDES, SELENIDES, AND TELLURIDES.

The elements sulphur, selenium, and tellurium bear a marked resemblance to one another and present close analogies in their properties, occurrence, and mode of combining with other elements. The terms sulphide, selenide, and telluride include all those compounds, derivatives of H_2S, H_2Se, and H_2Te, in which sulphur, selenium, or tellurium forms the sole or chief negative part. The three negative elements are essentially isomorphous and may replace one another in varying amounts.

CLASS,—SULPHIDES.

Group 1.

Realgar.	As_2S_2.	Monoclinic.

Group 2.

Orpiment.	As_2S_3.	Orthorhombic.
Dimorphite.		
Stibnite.	Sb_2S_3.	Orthorhombic.
Metastibnite.		
Bismuthinite.	Bi_2S_3.	Orthorhombic.

Group 3.

Molybdenite.	MoS_2.	Hexagonal.

Group 4.

Oldhamite.	CaS.	Isometric.
Sphalerite.	ZnS.	Isometric.
Marmatite.		
Przibramite.		
Wurtzite.	(Zn,Fe)S.	Hexagonal.
Erythrozincite.	(Zn,Mn)S.	Hexagonal.
Greenockite.	CdS.	Hexagonal.
Alabandite.	MnS.	Isometric.
Troilite.	FeS.	Isometric.
Folgerite.	(Fe,Ni)S.	Isometric.
Millerite.	NiS.	Hexagonal

Group 4—Continued.

Galena.	PbS.	Isometric.
Huascolite.		
Steinmannite.		
Covellite.	CuS.	Hexagonal.
Cantonite.		
Cinnabar.	HgS.	Hexagonal; rhombohedral.
Guadalcazarite.		
Leviglianite.		
Metacinnabarite.	HgS.	Isometric.

Group 5.

Chalcocite.	Cu_2S.	Orthorhombic.
Harrisite.		
Stromeyerite.	$(Cu,Ag)_2S$.	Orthorhombic.
Jalpaite.	$(Ag,Cu)_2S$.	Isometric.
Argentite.	Ag_2S.	Isometric.
Acanthite.	Ag_2S.	Orthorhombic.
Daleminzite.		

Group 6.

Pyrrhotite.	$Fe_{11}S_{12}$.	Hexagonal.
Horbachite.		

Group 7.

Pentlandite.	Ni_3FeS_5.	Isometric.

Group 8.

Polydymite.	Ni_4S_5.	Isometric.
Grünauite.		
Sychnodymite.	$(Co,Cu)_4S_5$.	Isometric.

Group 9.

Beyrichite.	Ni_3S_4.	(?)
Siegenite.	$(Co,Ni)_3S_4$.	(?)
Linnæite.	Co_3S_4.	Isometric.

Group 10.

Hauerite.	MnS_2.	Isometric.
Pyrite.	FeS_2.	Isometric.
Marcasite.	FeS_2.	Orthorhombic.
Laurite.	RuS_2.	Isometric.

Group 11.

Chalcopyrite.	$CuFeS_2$.	Tetragonal.
Barnhardtite.		
Homichlin.		
Bornite.	Cu_3FeS_3.	Isometric.
Castillite.		
Cubanite.	$CuFe_2S_4$.	Isometric.
Carrollite.	$CuCo_2S_4$.	Isometric.
Chalcopyrrhotite.	$CuFe_4S_6$.	(?)

Group 12.

Sternbergite.	$AgFe_2S_3$.	Orthorhombic.
Argentopyrite.	$AgFe_3S_5$.	Orthorhombic.
Frieseite.	$Ag_2Fe_5S_8$.	Orthorhombic.
Argyropyrite.	$Ag_3Fe_7S_{11}$.	Orthorhombic.

CLASS,—SELENIDES.

Group 1.

Guanajuatite.	Bi_2Se_3.	Orthorhombic.
Silaonite.		

Group 2.

Clausthalite.	PbSe.	Isometric.
Tilkerodite.		
Zorgite.		
Tiemannite.	HgSe.	Isometric; tetrahedral.
Lehrbachite.		
Onofrite.	Hg(S,Se).	(?)

Group 3.

Naumannite.	Ag_2Se.	Isometric.
Aguilarite.	$Ag_2(S,Se)$.	Isometric.
Berzelianite.	Cu_2Se.	(?)
Umangite.		
Eucairite.	$(Cu,Ag)_2Se$.	Isometric.
Crookesite.	$(Cu,Tl,Ag)_2Se$.	(?)

CLASS,—TELLURIDES.

Group 1.

Altaite.	PbTe.	Isometric
Henryite.		
Coloradoite.	HgTe.	(?)

Group 2.

Hessite.	Ag_2Te.	Isometric.
Stutzite.		
Petzite.	$(Ag,Au)_2Te$.	(?)

Group 3.

Sylvanite.	$(Au,Ag)Te_2$.	Monoclinic.
Krennerite.	$(Au,Ag)Te_2$.	Orthorhombic.
Calaverite.	$(Au,Ag)Te_2$.	Triclinic (?).

Group 4.

Nagyagite.	$Au_2Pb_{14}Sb_3(S,Te)_{24}$.	Orthorhombic.
Nobilite.		

Group 5.

Tetradymite.	Bi_2Te_3.	Hexagonal; rhombohedral.
Josëite.	$Bi_2(Te,S)_3$.	(?)
Melonite.	Ni_2Te_3(?).	Hexagonal.

Group 6.

Wehrlite.	$AgBi_7Te_7$(?).	(?)

CLASS,—ARSENIDES, ANTIMONIDES, AND BISMUTHIDES.

Arsenic, antimony, and bismuth are analogous in their properties and unite with other elements to form arsenides, antimonides, and bismuthides. Arsenic and antimony, and to a certain extent bismuth, are essentially isomorphous and may replace one another in varying amounts. With the arsenides, antimonides, and bismuthides are included the sulpharsenides, sulphantimonides, and sulphbismuthides—compounds in which the negative part is taken by arsenic, antimony, or bismuth with sulphur.

	Group 1.	
Niccolite.	NiAs.	Hexagonal.
Arite.	Ni(As,Sb).	Hexagonal.
Breithauptite.	NiSb.	Hexagonal.
	Group 2.	
Löllingite.	$FeAs_2$.	Orthorhombic.
Safflorite.	$CoAs_2$.	Orthorhombic.
Smaltite.	$CoAs_2$.	Isometric.
Chloanthite.	$NiAs_2$.	Isometric.
Rammelsbergite.	$NiAs_2$.	Orthorhombic.
Sperrylite.	$PtAs_2$.	Isometric.
	Group 3.	
Skutterudite.	$CoAs_3$.	Isometric.
Nickel-skutterudite.		
Bismutosmaltine.	$Co(As,Bi)_3$.	Isometric.
	Group 4.	
Leucopyrite.	Fe_3As_4.	Orthorhombic.
Geyerite.		
Glaucopyrite.		
	Group 5.	
Maldonite.	Au_2Bi.	(?)
	Group 6.	
Domeykite.	Cu_3As.	(?)
Orileyite.		
Dyscrasite.	Ag_3Sb.	Orthorhombic.
Animikite.		
Huntilite.	Ag_3As.	(?)
	Group 7.	
Algodonite.	Cu_6As.	(?)
Horsfordite.	Cu_6Sb.	(?)
Chilenite.	Ag_6Bi.	(?)
	Group 8.	
Whitneyite.	Cu_9As.	(?)

Group 9.

Cobaltite.	$CoAsS$.	Isometric.
Gersdorffite.	$NiAsS$.	Isometric.
Sommarugaite.		
Corynite.	$Ni(As,Sb)S$.	Isometric.
Ullmannite.	$NiSbS$.	Isometric.
Willyamite.	$(Ni,Co)SbS$.	Isometric.
Kallilite.	$Ni(Sb,Bi)S$.	Isometric.
Wolfachite.	$Ni(Sb,As)S$.	Orthorhombic.
Lautite.	$CuAsS$.	Orthorhombic.

Group 10.

Arsenopyrite.	$Fe(As,S)_2$.	Orthorhombic.
Danaite.		
Glaucodote.	$(Fe,Co)(As,S)_2$.	Orthorhombic.
Alloclasite.		

Group 11.

Hauchecornite.	$(Ni,Co,Fe)_7(Bi,Sb,As)_8$.	Tetragonal.

CLASS,—SULPHOSALTS.

This class includes the various native salts of the sulphoacids, H_3RS_3, H_2RS_2, $H_4R_2S_5$, etc., of arsenic, antimony, bismuth, tin, and germanium. The several compounds are arranged with reference to their negative parts as follows: A. Sulpharsenites, sulphantimonites, and sulphbismuthites. B. Sulpharsenates and sulphantimonates. C. Sulphstannates and sulphgermanates.

A. SULPHARSENITES, SULPHANTIMONITES, AND SULPHBISMUTHITES.

Group 1.

Livingstonite.	$HgSb_4S_7$.	Orthorhombic.

Group 2.

Chiviatite.	$Pb_2Bi_6S_{11}$.	(?)
Cuprobismutite.	$Cu_6Bi_8S_{15}$.	Orthorhombic.
Dognáckite.		
Rezbanyite.	$Pb_4Bi_{10}S_{19}$	(?)

Group 3.

Berthierite.	$FeSb_2S_4$.	Orthorhombic.
Sartorite.	$PbAs_2S_4$.	Orthorhombic.
Zinkenite.	$PbSb_2S_4$.	Orthorhombic.
Galenobismutite.	$PbBi_2S_4$.	(?)
Andorite.	$(Pb,Ag_2)Sb_2S_4$.	Orthorhombic
Alaskaite.	$(Pb,Ag_2,Cu_2)Bi_2S_4$.	(?)

Group 4.

Chalcostibite.	$Cu_2Sb_2S_4$.	Orthorhombic.
Emplectite.	$Cu_2Bi_2S_4$.	Orthorhombic.

	Group 5.	
Lorandite.	$TlAsS_2$.	Monoclinic.
Miargyrite.	$AgSbS_2$.	Monoclinic.
Plenargyrite.	$AgBiS_2$.	Monoclinic.
Matildite.	$AgBiS_2$.	Orthorhombic.
	Group 6.	
Plagionite.	$Pb_5Sb_8S_{17}$.	Monoclinic.
	Group 7.	
Binnite.	$Cu_6As_4S_9$.	Isometric.
Klaprotholite.	$Cu_6Bi_4S_9$	Orthorhombic.
	Group 8	
Warrenite.	$Pb_3Sb_4S_9$.	(?)
Schirmerite.	$(Pb,Ag_2)_3Bi_4S_9$.	(?)
	Group 9.	
Dufrenoysite.	$Pb_2As_2S_5$.	Orthorhombic.
Rathite.	$Pb_4As_2Sb_2S_{10}$.	Orthorhombic.
Jamesonite.	$Pb_2Sb_2S_5$.	Orthorhombic.
Kobellite.	$Pb_2(Bi,Sb)_2S_5$.	(?)
Cosalite.	$Pb_2Bi_2S_5$.	Orthorhombic.
Schapbachite.	$(Pb,Ag_2)_2Bi_2S_5$.	Orthorhombic (?).
Brongniardtite	$(Pb,Ag_2)_2Sb_2S_5$.	Isometric.
	Group 10.	
Semseyite.	$Pb_7Sb_6S_{16}$	Monoclinic.
	Group 11.	
Diaphorite.	$(Pb,Ag_2)_5Sb_4S_{11}$.	Orthorhombic.
Freieslebenite.	$(Pb,Ag_2)_5Sb_4S_{11}$.	Monoclinic.
	Group 12.	
Guitermanite.	$Pb_3As_2S_6$.	(?)
Boulangerite.	$Pb_3Sb_2S_6$.	(?)
Embrithite.		
Plumbostib.		
Lillianite.	$Pb_3Bi_2S_6$.	(?)
	Group 13	
Wittichenite.	$Cu_6Bi_2S_6$.	Orthorhombic.
Tapalpite.	$Ag_6Bi_2(S,Te)_6$.	(?)
	Group 14.	
Bournonite.	$Pb_3Cu_2Sb_2S_6$.	Orthorhombic.
Aikinite.	$Pb_3Cu_2Bi_2S_6$.	Orthorhombic.
Stylotypite.	$Fe_3(Cu,Ag)_2Sb_2S_6$.	(?)
	Group 15.	
Proustite.	Ag_3AsS_3.	Hexagonal; rhombohedral.
Pyrargyrite.	Ag_3SbS_3.	Hexagonal; rhombohedral.
Xanthoconite.	Ag_3AsS_3.	Monoclinic.
Pyrostilpnite.	Ag_3SbS_3.	Monoclinic.

Group 16.

Tennantite.	$Cu_8As_2S_7$.	Isometric; tetrahedral.
Sandbergite.		
Fredricite.		
Rionite.		
Tetrahedrite.	$Cu_8Sb_2S_7$.	Isometric; tetrahedral.
Freibergite.		
Schwatzite.		
Malinowskite.		
Polytelite.		

Group 17.

Jordanite.	$Pb_4As_2S_7$.	Monoclinic.
Meneghinite.	$Pb_4Sb_2S_7$.	Orthorhombic.

Group 18.

Geocronite.	$Pb_5Sb_2S_8$.	Orthorhombic.
Stephanite.	$Ag_{10}Sb_2S_8$.	Orthorhombic.

Group 19.

Kilbrickenite.	$Pb_6Sb_2S_9$.	(?)
Beegerite.	$Pb_6Bi_2S_9$.	Isometric.
Richmondite.		

Group 20.

Pearceite.	$(Ag,Cu)_9AsS_6$.	Monoclinic.
Polybasite.	$(Ag,Cu)_9SbS_6$.	Monoclinic.

Group 21.

Polyargyrite.	$Ag_{24}Sb_2S_{15}$.	Isometric.

B. SULPHARSENATES AND SULPHANTIMONATES.

Group 1.

Enargite.	Cu_3AsS_4.	Orthorhombic.
Clarite.		
Luzonite.		
Famatinite.	Cu_3SbS_4.	Orthorhombic.
Epiboulangerite.	$Pb_3Sb_2S_8$.	Orthorhombic (?).

Group 2.

Epigenite.	$Fe_3Cu_8As_2S_{12}$.	Orthorhombic.

C. SULPHSTANNATES AND SULPHGERMANATES.

Group 1.

Stannite.	$FeCu_2SnS_4$.	Isometric.
Frankeite.	$Pb_5Sb_2Sn_2S_{12}$.	(?)
Plumbostannite.	$Pb_2(Fe,Zn)_2Sb_2Sn_2S_{11}$.	(?)
Kylindrite.	$Pb_6Sb_2Sn_6S_{21}$.	(?)

Group 2.

Canfieldite.	$Ag_8(Sn,Ge)S_6$.	Isometric.
Argyrodite.	Ag_8GeS_6.	Isometric.

C. OXYGEN COMPOUNDS.

From the abundance of oxygen and its nearly universal affinities its combinations form by far the largest number of the compounds of the elements. The minerals of this division fall into two general groups. To the first group the general name oxides is given: to the second, oxygen salts. The oxygen salts include a number of classes of minerals, such as carbonate, silicate, and phosphate.

CLASS,—OXIDES.

The compounds resulting from the union of oxygen with other elements bear the general name oxides. Considering the class as a whole, the hydrogen atom or atoms in the typical oxide H_2O may be replaced by a single element, as in cuprite Cu_2O, or by a group of elements, as in göthite $FeO(OH)$. Further, the oxygen may be replaced in part by sulphur, as in kermesite Sb_2S_2O; thus giving rise to three general groups: anhydrous oxides, hydroxides, and sulphoxides.

A. ANHYDROUS OXIDES.

Group 1.

Tellurite.	TeO_2.	Orthorhombic.
Selenolite.	SeO_2.	(?)

Group 2.

Molybdite.	MoO_3.	Orthorhombic.
Ilsemannite.		
Tungstite.	WO_3.	Orthorhombic.
Meymacite.		

Group 3.

Arsenolite.	As_2O_3.	Isometric.
Claudetite.		Monoclinic.
Senarmontite.	Sb_2O_3.	Isometric.
Valentinite.		Orthorhombic.
Bismite.	Bi_2O_3.	(?)

Group 4.

Periclase.	MgO.	Isometric.
Zincite.	ZnO.	Hexagonal.
Massicot.	PbO.	(?)
Manganosite.	MnO.	Isometric.
Bunsenite.	NiO.	Isometric.
Tenorite.	CuO.	Monoclinic.
Melaconite.		
Marcylite.		

Group 5.

Ice (water).	H_2O.	Hexagonal.
Cuprite.	Cu_2O.	Isometric.

Group 6.

Quartz.	SiO_2.	Hexagonal; rhombohedral.
Amethyst.		
Smoky.		
Citrine.		
Rose.		
Cotterite.		
Chalcedony.		
Chrysoprase.		
Prase.		
Plasma.		
Agate.		
Flint.		
Jasper.		
Basanite.		
Beekite, etc.		
Tridymite.	SiO_2.	Orthorhombic.
Christobalite.	SiO_2.	Tetragonal.
Rutile.	TiO_2.	Tetragonal.
Octahedrite.	TiO_2.	Tetragonal.
Brookite.	TiO_2.	Orthorhombic.
Arkansite.		
Eumanite.		
Baddeleyite.	ZrO_2.	Monoclinic.
Cassiterite.	SnO_2.	Tetragonal.
Ainalite.		
Plattnerite.	PbO_2.	Tetragonal.
Polianite.	MnO_2.	Tetragonal.
Pyrolusite.	MnO_2.	Orthorhombic (?).

Group 7.

Corundum.	Al_2O_3.	Hexagonal; rhombohedral.
Ruby.		
Sapphire.		
Emery.		
Hematite.	Fe_2O_3.	Hexagonal; rhombohedral.
Martite.		
Långbanite.	$Mn(Mn,Si)O_3$.	Hexagonal; rhombohedral.

Contains also Sb_2O_3 and Fe_2O_3.

B. HYDROXIDES.

Group 1.

Brucite.	$Mg(OH)_2$.	Hexagonal; rhombohedral.
Nemalite.		
Manganbrucite.		
Ironbrucite.		
Pyrochroite.	$Mn(OH)_2$.	Hexagonal; rhombohedral.

Group 2.

Sassolite.	$B(OH)_3$.	Triclinic.
Gibbsite.	$Al(OH)_3$.	Monoclinic.
Zirlite.		
Namaqualite.		

Group 3.

Diaspore.	$AlO(OH)$.	Orthorhombic.
Manganite.	$MnO(OH)$.	Orthorhombic.
Göthite.	$FeO(OH)$.	Orthorhombic.
Onegite.		

Group 4.

Bauxite.	$Al_2O(OH)_4$.	(?)
Wocheinite.		
Xanthosiderite.	$Fe_2O(OH)_4$.	(?)
Winklerite.	$(Co,Ni)_2O(OH)_4$.	(?)

Group 5.

Turgite.	$Fe_4O_5(OH)_2$.	(?)

Group 6.

Limonite.	$Fe_4O_3(OH)_6$.	(?)
Heubachite.	$(Co,Ni)_4O_3(OH)_6$.	(?)
Heterogenite.		

Group 7.

Opal.	$SiO_2(H_2O)_n$.	Amorphous.
Lussatite.		
Forcherite.		
Fiorite.		
Geyserite.		
Tripolite.		

Group 8.

Hydrotalcite.	$3Mg(OH)_2.Al(OH)_3.3H_2O$.	Hexagonal.
Houghite.		
Pyroaurite.	$3Mg(OH)_2.Fe(OH)_3.3H_2O$.	Hexagonal.

C. SULPHOXIDES.

Group 1.

Kermesite.	Sb_2S_2O.	Monoclinic.
Karelinite.	Sulphoxide of bismuth.	(?)

Group 2.

Voltzite.	Zn_5S_4O.	Hexagonal.
Igelströmite.		

OXYGEN SALTS: CLASS,—BORATES, ALUMINATES, CHROMITES, FERRITES, MANGANITES, AND PLUMBATES.

The minerals here included may be regarded as derivatives of HBO_2, H_2BO_3, $H_2B_4O_7$, $HAlO_2$, $HCrO_2$, $HFeO_3$, $HMnO_2$, $HMnO_3$, and $HPbO_2$, or as compounds of other oxides with the trioxides of boron, aluminum, chromium, iron, manganese, and lead, forming respectively borates, aluminates, chromites, ferrites, manganites, and plumbates.

A. BORATES.

Group 1.

Jeremejevite.	$AlBO_3$.	Hexagonal.
Rhodizite.	$(K,Cs,Rb)Al_2B_3O_8$.	Isometric; tetrahedral.
Pinakiolite.	$Mg_3Mn_3B_2O_{10}$.	Orthorhombic.
Ludwigite.	$Mg_3Fe_3B_2O_{10}$.	Orthorhombic.
Hambergite.	$Gl_2(OH)BO_3$.	Orthorhombic.
Sussexite.	$(Mg,Zn,Mn)HBO_3$.	(?)
Szaibelyite.	$Mg_{10}H_6B_8O_{25}$.	(?)
Boracite.	$Mg_7Cl_2B_{16}O_{30}$.	Isometric; tetrahedral.
Stassfurtite.		
Parasite.		
Nordenskiöldine.	$CaSn(BO_3)_2$.	Hexagonal; rhombohedral.
Howlite.	$Ca_2SiH_5B_5O_{14}$.	Orthorhombic (?).
Warwickite.	$Mg_6FeTi_2B_6O_{20}$.	Orthorhombic.

Group 2.

Pinnoite.	$MgB_2O_4.3H_2O$.	Tetragonal.
Lagonite.	$FeB_3O_6.1\frac{1}{2}H_2O$.	(?)
Borax.	$Na_2B_4O_7.H_2O$.	Monoclinic.
Tincalconite.		
Bechilite.	$CaB_4O_7.4H_2O$.	(?)
Hayesine.		
Ascharite.	$3Mg_2B_2O_5.2H_2O$.	(?)
Ulexite.	$NaCaB_5O_9.8H_2O$.	(?)
Priceite.	$Ca_2B_6O_{11}.3H_2O$.	(?)
Colemanite.	$Ca_2B_6O_{11}.5H_2O$.	Monoclinic.
Franklandite.	$CaNa_2B_6O_{11}.7H_2O$.	(?)
Hydroboracite.	$CaMgB_6O_{11}.6H_2O$.	Monoclinic (?).
Larderellite.	$(NH_4)_2B_8O_{13}.4H_2O$.	Monoclinic.
Heintzite.	$KMg_2B_3O_{16}.8H_2O$(?).	Monoclinic.

Group 3.

Sulphoborite.	$Mg_3(SO_4)_3.Mg_4B_8O_{18}.12H_2O$.	Orthorhombic.

B. ALUMINATES.

Group 1.

Chrysoberyl.	$GlAl_2O_4$.	Orthorhombic.
Alexandrite.		
Spinel.	$MgAl_2O_4$.	Isometric.
Ceylonite.		
Chlorospinel.		
Picotite.		
Gahnite.	$ZnAl_2O_4$.	Isometric.
Automolite.		
Dysluite.		
Kreittonite.		
Hercynite.	$FeAl_2O_4$.	Isometric.

C. CHROMITES AND FERRITES.

Group 1.

Chromite.	$FeCr_2O_4$.	Isometric.
Chrompicotite.		
Magnochromite.		
Magnesioferrite.	$MgFe_2O_4$.	Isometric.
Jacobsite.	$(Mg,Mn)(Fe,Mn)_2O_4$.	Isometric.
Magnetite.	$FeFe_2O_4$.	Isometric.
Franklinite.	$(Fe,Zn,Mn)(Fe,Mn)_2O_4$.	Isometric.

D. MANGANITES.

Group 1.

Hausmannite.	Mn_2MnO_4.	Tetragonal.
Braunite.	$MnMnO_3$.	Tetragonal.
Bixbyite.	$FeMnO_3$.	Isometric.
Crednerite.	$2MnMnO_3.3CuO$.	Monoclinic.
Chalcophanite.	$(Mn,Zn)Mn_2H_4O_7$.	Hexagonal; rhombohedral.
Psilomelane.	Hydrated mangan-manganite.	(?)
Lithiophorite.		
Wad.		
Asbolite.		
Lampadite.		
Varvicite.		

E. PLUMBATES.

Group 1.

Minium.	Pb_2PbO_4.	(?)

OXYGEN SALTS: CLASS,—ARSENITES AND ANTIMONITES.

The arsenites and antimonites, derivatives of $As(OH)_3$ and $Sb(OH)_3$, or compounds of oxides with oxides in which the more negative parts are taken by arsenious and antimonious oxides, include both anhydrous and hydrous salts, together with a few chloriferous compounds.

Group 1.

Romeite.	$CaSb_2O_4$.	Tetragonal.
Trippkeite.	Copper arsenate.	Tetragonal.

Group 2.

Thrombolite.	$Cu_3Sb_2O_6.H_2O$.	(?)
Coronguite.	Hydrated antimonite of lead.	(?)
Partzite.	Hydrated antimonite of lead, copper, and silver.	(?)

Group 3.

Nadorite.	$PbClSbO_2$.	Orthorhombic.
Ecdemite.	$Pb_6Cl_4As_2O_7$.	Orthorhombic.
Ochrolite.	$Pb_6Cl_4Sb_2O_7$.	Orthorhombic.

OXYGEN SALTS: CLASS,—SELENITES AND TELLURITES.

The selenites and tellurites, derivatives of $Se(OH)_4$ and $Te(OH)_4$, or compounds of oxides with oxides whose more negative parts are taken by selenous and tellurous oxides, have but few representatives among minerals, and these are of rare occurrence.

Group 1.

Molybdomenite.	$PbSeO_3$.	Orthorhombic.
Kerstenite.		
Cobaltomenite.	$CoSeO_3$.	(?)
Chalcomenite.	$CuSeO_3$.	Monoclinic.
Emmonsite.	Tellurite of iron.	Monoclinic (?).

Group 2.

Durdenite.	$Fe_2(TeO_3)_2.4H_2O$.	(?)

OXYGEN SALTS: CLASS,—CARBONATES.

The carbonates, derivatives of H_2CO_3, or compounds of carbon dioxide with other oxides, form a numerous and important class of minerals. They may be conveniently arranged as follows: Normal carbonates, compounds in which the ratio of oxygen in the carbon dioxide to the oxygen in the combined oxide is as 2:1; basic carbonates, compounds in which the ratio of the number of the oxgyen atoms in the dioxide to that of the combined oxide is less than 2:1; fluo and chlorocarbonates, compounds in which there is a fluoride or chloride with a carbonate of the same element.

A. NORMAL CARBONATES.

Group 1.

α. Rhombohedral section.

Calcite.	$CaCO_3$.
Brunnerite.	
Reichite.	
Hislopite.	
Thinolite.	
Dolomite.	$(Ca,Mg)CO_3$.
Ankerite.	$(Ca,Mg,Fe,Mn)CO_3$.
Magnesite.	$MgCO_3$.
Breunnerite.	
Mesitite.	$(Mg,Fe)CO_3$.
Pistomesite.	
Siderite.	$FeCO_3$.
Siderodot.	
Thomäite.	
Oligonite.	
Rhodochrosite.	$MnCO_3$.
Manganocalcite.	
Smithsonite.	$ZnCO_3$.
Monheimite.	
Sphærocobaltite.	$CoCO_3$.

β. Orthorhombic section.

Aragonite.	$CaCO_3$.	
Bromlite.	$(Ca,Ba)CO_3$.	
Witherite.	$BaCO_3$.	
Strontianite.	$SrCO_3$.	
Emmonite.		
Cerussite.	$PbCO_3$.	
Tarnowitzite.		

γ. Monoclinic section.

Barytocalcite.	$(Ba,Ca)CO_3$.	

Group 2.

Teschermacherite.	HNH_4CO_3.	Orthorhombic.

Group 3.

Natron.	$Na_2CO_3.10H_2O$.	Monoclinic.
Thermonatrite.	$Na_2CO_3.H_2O$.	Orthorhombic.
Nesquehonite.	$MgCO_3.H_2O$.	Orthorhombic.

Group 4.

Lanthanite.	$La_2(CO_3)_3.9H_2O$.	Orthorhombic.
Tengerite.	Hydrated yttrium carbonate.	(?)

Group 5.

Uranothallite.	$UCa_2(CO_3)_4.10H_2O$.	Orthorhombic.
Liebigite.		

Group 6.

Trona.	$HNa_3(CO_3)_2.2H_2O$.	Monoclinic.
Urao.		
Pirssonite.	$Na_2Ca(CO_3)_2.2H_2O$.	Orthorhombic.
Gay-Lussite.	$Na_2Ca(CO_3)_2.5H_2O$.	Monoclinic.

B. BASIC CARBONATES.

Group 1.

Bismutosphærite.	$(BiO)_2CO_3$.	(?)
Bismutite.		
Walthérite.		

Group 2.

Hydrozincite.	$Zn_3(OH)_4CO_3$.	(?)
Malachite.	$Cu_2(OH)_2CO_3$.	Monoclinic.
Azurite.	$Cu_3(OH)_2(CO_3)_2$.	Monoclinic.
Zinkazurite.		
Atlasite.		
Hydrocerussite.	$Pb_3(OH)_2(CO_3)_2$.	Hexagonal.
Aurichalcite.	$(Zn,Cu)_5(OH)_6(CO_3)_2$.	Monoclinic (?).

Group 3.

Dawsonite.	$NaAl(OH)_2CO_3$.	Monoclinic.
Hovite.		

Group 4.

Hydrogiobertite.	$Mg_2(OH)_2CO_3.2H_2O$.	(?)
Hydromagnesite.	$Mg_4(OH)_2(CO_3)_3.3H_2O$.	Monoclinic.
Hydrodolomite.		

Group 4—Continued.

Lansfordite.	$Mg_4(OH)_2(CO_3)_3.21H_2O$.	Triclinic.
Zaratite.	$Ni_3(OH)_4CO_3.4H_2O$.	(?)
Remingtonite.		

C. FLUO—AND CHLOROCARBONATES.

Group 1.

Parisite.	$[(Ca,Ce)F_2]Ce(CO_3)_3$.	Hexagonal.
Kischitimite.		
Weibeyite.		
Bastnäsite.	$[(Ce,La,Di)F]CO_3$.	Hexagonal (?).

Group 2.

Phosgenite.	$(PbCl)_2CO_3$.	Tetragonal.

OXYGEN SALTS: CLASS,—SILICATES.

The silicates, derivatives of the several silicic acids H_4SiO_4, H_2SiO_3, H_2SiO_7, H_2SiO_5, and $H_4Si_3O_8$, or compounds of silicon oxide with other oxides, constitute about nine-tenths of the known crust of the earth and more than one fourth of the known kinds of minerals. Isomorphic combinations are the rule, and the class exhibits great diversity of composition. For example, the ratio of oxygen in silica to that in combined oxide may vary for monad and dyad elements, such as potassium or calcium, between 2:4 and 4:1; and for silicates of triad elements, such as aluminum or iron, between 2:6 and 12:3. Again, it is not unusual to find a silicate containing both potassium and calcium, or the oxides of iron and aluminum, or of calcium and aluminum, and that not necessarily in atomic proportion. But although certain oxides are capable of mutual replacement in any and all proportions, such as the sesquioxides of iron, aluminum, etc., or the monoxides of calcium, magnesium, iron, manganese, sodium, lithium, etc.; and though a silicate may contain at once a mixture of sesquioxides and monoxides in combination with silica, the place of a monoxide is not taken by a sesquioxide, nor that of a sesquioxide by a monoxide.

Group 1.

Petalite.	$AlLi(Si_2O_5)_2$.	Monoclinic.
Hydrocastorite.		
Milarite.	$Al_2Ca_2KH(Si_2O_5)_6$.	Hexagonal.

Group 2. The Pyroxenes.

α. Orthorhombic section.

Enstatite.	$MgSiO_3$.
Bronzite.	
Diaclasite.	
Bastite.	
Hypersthene.	$(Fe,Mg)SiO_3$.
Amblystegite.	
Szaboite.	

β. Monoclinic section.

Diopside.	$CaMg(SiO_3)_2$.
Hedenbergite.	$CaFe(SiO_3)_2$.
Manganhedenbergite.	$Ca(Fe,Mn)(SiO_3)_2$.
Schefferite.	$(Ca,Mg)(Fe,Mn)(SiO_3)_2$.
Jeffersonite.	$(Ca,Mg)(Fe,Mn,Zn)(SiO_3)_2$.
Augite.	Chiefly $Ca(Mg,Fe)(SiO_3)_2$, with $(Mg,Fe)(Al,Fe)SiO_6$.
Spodumene.	$LiAl(SiO_3)_2$.
Hiddenite.	
Jadeite.	$NaAl(SiO_3)_2$.
Chloromelanite.	
Acmite.	$NaFe(SiO_3)_2$.
Ægirite.	
Urbanite.	$NaFe(Ca,Mg)(SiO_3)_3$.
Lindesite.	$NaFe(Ca,Mn)(SiO_3)_3$.

γ. Triclinic section.

Rhodonite.	$MnSiO_3$.
Paisbergite.	$(Mn,Ca)SiO_3$.
Bustamite.	$(Mn,Fe)SiO_3$.
Fowlerite.	$(Mn,Zn,Fe,Ca)SiO_3$.
Babingtonite.	$Fe(Ca,Fe,Mn)(SiO_3)_3$.

Δ. Zircon Pyroxenes.

Rosenbuschite.	$Na_4Ca_2F_4Zr_2Ti_2Si_3O_{16}$.	Monoclinic.
Låvenite.	$Na_2CaMnZrSiO_3$. Contains also F,Cb, and Ti in small amounts.	Monoclinic.
Wöhlerite.	$Na_5Ca_{10}F_3Zr_3Cb_2Si_{10}O_{42}$.	Monoclinic.
Hiortdahlite.	$Na_4Ca_{12}F_6(Si,Zr,Ti)_{14}O_{39}$.	Triclinic.

Group 2A.

Wollastonite.	$Ca_3(SiO_3)_3$.	Monoclinic.
Pectolite.	$HNaCa_2(SiO_3)_3$.	Monoclinic.
Manganpectolite.		

Group 3. The Amphiboles.

α. Orthorhombic section.

Anthophyllite.	$(Mg,Fe)SiO_3$.
Kupfferite.	
Thalackerite.	
Gedrite.	

β. Monoclinic section.

Tremolite.	$CaMg_3(SiO_3)_4$.
Actinolite.	$Ca(Mg,Fe)_3(SiO_3)_4$.
Nephrite.	
Smaragdite.	
Asbestus in part.	
Cummingtonite.	$(Fe,Mg)SiO_3$.
Dannemorite. Silfbergite. Hillängsite.	$(Fe,Mn,Mg)SiO_3$.

β. Monoclinic section—Continued.

Grünerite.	$FeSiO_3$.	
Richterite.	$[(K,Na)_2Mg,Ca,Mn]SiO_3$.	
Edenite. Pargasite. Hornblende.	Chiefly $Ca(Mg,Fe)_3(SiO_3)_4$, with $Na_2Al_2(SiO_3)_4$ and $(Mg,Fe)_2(Al,Fe)_4Si_2O_{12}$.	
Crocidolite.	$NaFe_2(SiO_3)_3$.	
Glaucophane.	$NaAl(Mg,Fe,Ca)_2(SiO_3)_4$.	
Riebeckite.	$NaFe(Fe,Mg,Ca)_2(SiO_3)_4$.	
Arfvedsonite.	$Na_4Al(Al,Fe)(Fe,Mg,Ca)_3Si_3O_{12}$.	
Barkevikite.		

γ. Triclinic section.

Ænigmatite.	$(Na,K)_8Na_2Al_2Fe_4(Fe,Mn.MgCa)(Si,Ti)_4Si_8O_{36}$.	
Cossyrite.		

Group 4.

Leucite.	$(K,Na)Al(SiO_3)_2$.	Isometric at 500° C.

Group 5.

Pollucite.	$H_2(Cs,Na)_2Al(SiO_3)_5$.	Isometric.

Group 6.

Hyalotekite.	$R_2B_2(SiO_3)_{12}$. R=Pb,Ba,Ca; also contains Gl,F,K,etc.	(?)

Group 7.

Beryl.	$Gl_3Al_2(SiO_3)_6$.	Hexagonal.
Cesium Beryl.		
Emerald.		
Rosterite.		

Group 8.

Leucophanite.	$NaCa(GlF)(SiO_3)_2$.	Orthorhombic.
Meliphanite.	$GlNaCa_2GlFSi_3O_{10}$.	Tetragonal.

Group 9.

Iolite.	$Al_6Mg_4(AlOH)_2(Si_2O_7)_5$.	Orthorhombic.
Cerasite. Fahlunite. Auralite. Chlorophyllite. Aspasiolite. Pyrargillite. Gigantolite, etc.	Alteration products of Iolite.	

Group 10.

Ransätite.	$(Fe,Al)_4(Mn,Ca,Mg)_3(Si_2O_7)_3$.	Isometric.

Group 11.

Rowlandite.	$(Fe,Mg)(Y,Ce,La)_2(YF)_2(Si_2O_7)_2$.	Isometric (?)
Yttrialite.		
Thalénite.		

Group 12.

Barysilite.	$Pb_3Si_2O_7$.	Hexagonal.
Ganomalite.	$(Pb,Ca)_3Si_2O_7$.	Tetragonal.

Group 13.

Kentrolite.	$Pb_2(MnO)_2Si_2O_7$.	Orthorhombic.
Melanotekite.	$Pb_2(FeO)_2Si_2O_7$.	Orthorhombic.
Guarinite.	$(Ca,Na_2,K_2)_2[(Al,Fe,Ce)O]_2Si_2O_7$.	Orthorhombic.

Group 14.

Eudidymite. } Epididymite. }	$HNaGlSi_3O_8$.	Monoclinic. Orthorhombic.

Group 15.

Elpidite.	$H_6Na_2ZrSi_6O_{18}$.	Orthorhombic.
Catapleiite.	$H_4(Na_2,Ca)ZrSi_3O_{11}$.	Monoclinic; pseudo-hexagonal.
Natron-catapleiite.		
Eudialyte.	$Na_{13}(Ca,Fe)_6Cl(Zr,Si)_2O_{52}$.	Hexagonal; rhombohedral.
Eucolite.		

Group 16. The Feldspars.

α. Monoclinic section.

Orthoclase.	$KAlSi_3O_8$.
Adularia.	
Sanidine.	
Soda orthoclase.	$(K,Na)AlSi_3O_8$.
Hyalophane.	$(K_2,Ba)Al_2Si_4O_{12}$.

β. Triclinic section.

Microcline.	$KAlSi_3O_8$.
Amazonstone.	
Anorthoclase.	$(Na,K)AlSi_3O_8$.

The Plagioclases.

Albite.	$NaAlSi_3O_8$.
Oligoclase. Andesine. Labradorite.	Mixtures of $NaAlSi_3O_8$ and $CaAl_2(SiO_4)_2$.
Anorthite.	$CaAl_2(SiO_4)_2$.
Celsian.	$BaAl_2(SiO_4)_2$.

Group 17.

Eucryptite.	$LiAlSiO_4$.	Hexagonal.
Nephelite.	$NaAlSiO_4$.	Hexagonal.
Kaliophilite.	$KAlSiO_4$.	Hexagonal.

Group 18.

Cancrinite.	$HNa_4(AlCO_3)Al_2(SiO_4)_3$.	Hexagonal.
Microsommite.	$(Na,K)_3Ca[Al(SO_4,Cl_3)]Al_2(SiO_4)_3$.	Hexagonal.
Davyne.		
Cavolinite.		

Group 19.

Sodalite.	$Na_4(AlCl)Al_2(SiO_4)_3$.	Isometric.
Haüynite.	$Na_2Ca(AlSO_4Na)Al_2(SiO_4)_3$.	Isometric.
Noselite.	$Na_4(AlSO_4Na)Al_2(SiO_4)_3$.	Isometric.
Ittnerite.		
Scolopsite.		
Lazurite.	$Na_4(AlS_3Na)Al_2(SiO_4)_3$.	Isometric.
Lapis-Lazuli.		

Group 20.

Helvite.	$Gl_3(Fe,Mn)_2Mn_2S(SiO_4)_3$.	Isometric; tetrahedral.
Danalite.	$Gl_3(Fe,Mn,Zn)_2(Zn,Fe)_2S(SiO_4)_3$.	Isometric.

Group 21.

Eulytite. } Agricolite. }	$Bi_4(SiO_4)_3$.	{ Isometric. { Monoclinic.

Group 22. The Garnets.

Grossularite.	$Al_2Ca_3(SiO_4)_3$.	Isometric.
Essonite.	$(Al,Fe)_2Ca_3(SiO_4)_3$.	Isometric.
Andradite.	$Fe_2Ca_3(SiO_4)_3$.	Isometric.
Ouvarovite.	$Cr_2Ca_3(SiO_4)_3$.	Isometric.
Pyrope.	$(Fe,Al)_2Mg_3(SiO_4)_3$.	Isometric.
Rhodolite.		
Almandite.	$(Fe,Al)_2(Mg,Fe)_3(SiO_4)_3$.	Isometric.
Spessartite.	$(Fe,Al)_2(Fe,Mn)_3(SiO_4)_3$.	Isometric.
Melanite.	$(Fe,Al,Ti)_2[(Si,Ti)O_4]_3$.	Isometric.
Schorlomite.	$(Fe,Ti)_2[(Si,Ti)O_4]_3$.	Isometric.
Ivaarite.		
Partschinite.	$Al_2Mn_3(SiO_4)_3$.	Monoclinic.

Group 23.

Monticellite.	$CaMgSiO_4$.	Orthorhombic.
Batrachite.		
Forsterite.	Mg_2SiO_4.	Orthorhombic.
Boltonite.		
Chrysolite.	$(Mg,Fe)_2SiO_4$.	Orthorhombic.
Fayalite.	Fe_2SiO_4.	Orthorhombic.
Hortonolite.	$(Fe,Mg,Mn)_2SiO_4$.	Orthorhombic.
Rœpperite.	$(Fe,Mn,Mg,Zn)_2SiO_4$.	Orthorhombic.
Knebelite.	$(Mn,Fe)_2SiO_4$.	Orthorhombic.
Tephroite.	Mn_2SiO_4.	Orthorhombic.

Group 24.

Willemite.	Zn_2SiO_4.	Hexagonal; rhombohedral.
Phenacite.	Gl_2SiO_4.	Hexagonal; rhombohedral.
Trimerite.	$Gl(Mn,Ca)SiO_4$.	Pseudohexagonal; triclinic.

Group 25.

Dioptase.	CuH_2SiO_4.	Hexagonal; rhombohedral.
Chrysocolla.		
Pilarite.		
Asperolite.		
Bementite.	MnH_2SiO_4.	(?)

Group 26.

Caryopilite.	$Mn_4H_6Si_3O_{13}$.	(?)
Ekmanite.	$(Fe,Mn,Mg)_4H_6Si_3O_{13}$.	(?)

Group 27.

Friedelite.	$Mn_4H_7(MnCl)(SiO_4)_4$.	Hexagonal; rhombohedral.
Pyrosmalite.	$(Fe,Mn)_4H_7[(Fe,Mn)Cl](SiO_4)_4$.	Hexagonal; rhombohedral.

Group 28.

Sarcolite.	$NaCa_3Al_5Si_5O_{12}$.	Tetragonal.
Meionite.	$Ca_4Al_6Si_6O_{25}$.	Tetragonal.
Wernerite. Mizzonite. Dipyre.	Intermediate between meionite and marialite.	
Marialite.	$Na_4Al_3ClSi_9O_{24}$.	Tetragonal.
Atheriastite. Algerite. Wilsonite. Stroganovite. Couseranite.	Alteration products of scapolite.	

Group 29.

"Åkermanite."	$Ca_4Si_3O_{10}$.	Tetragonal.
Melilite. Fuggerite.	Mixtures of "akermanite" and gehlenite in which part of the Ca is replaced by Mg and Fe.	Tetragonal.
Gehlenite.	$Ca_3Al_2Si_2O_{10}$.	Tetragonal.

Group 30.

Vesuvianite.	$MgCa_5(AlOH)Al_2(SiO_4)_5$.	Tetragonal.
Xanthite.		
Cyprine.		

Group 31.

Zircon.	$ZrSiO_4$.	Tetragonal.
Tachyaphaltite. Auerbachite. Cyrtolite. Alvite.	Alteration products of zircon.	
Thorite.	$ThSiO_4$.	Tetragonal.
Calciothorite. Eucrasite. Freyalite. Auerlite.	Alteration products of thorite.	

Group 32.

Danburite.	$CaB_2(SiO_4)_2$.	Orthorhombic.
Barsowite.	$CaAl_2(SiO_4)_2$.	Orthorhombic.

Group 33.

Topaz.	$Al_2(F,OH)_2SiO_4$.	Orthorhombic.
Pycnite.		

Group 34.

Andalusite.	$Al_3(AlO)_3(SiO_4)_3$.	Orthorhombic.
Chiastolite.		
Sillimanite.	$Al_3(AlO)_3(SiO_4)_3$.	Orthorhombic.
Fibrolite.		
Bamlite.		
Xenolite.		
Wörthite.		
Westanite.		
Monrolite.		
Kyanite.	$Al(AlO)SiO_4$.	Triclinic.

Group 35.

Datolite.	$HCa(BO)SiO_4$.	Monoclinic.
Botryolite.		
Homilite.	$CaFe(BO)SiO_4$.	Monoclinic.
Erdmannite.		
Euclase.	$HGl(AlO)SiO_4$.	Monoclinic.
Gadolinite.	$GlFe(YO)SiO_4$.	Monoclinic.

Group 36.

Zoisite.		Orthorhombic.
Thulite.	$Ca_2Al_2(AlOH)(SiO_4)_3$.	
Klinozoisite.		Monoclinic.
Epidote.	$Ca_2(Al,Fe)_2[(Al,Fe)OH](SiO_4)_3$.	Monoclinic.
Picroepidote.		
Withamite.		
Piedmontite.	$Ca_2(Al,Mn)_2(AlOH)(SiO_4)_3$.	Monoclinic.
Allanite.	$(Ca,Fe)_2(Al,Ce,Fe)_2(AlOH)(SiO_4)_3$.	Monoclinic.
Bucklandite.		
Uralorthite.		
Bagrationite.		
Xanthorthite.		
Bodenite.		
Wasite.		
Muromontite.		
Pyrorthite.		

Group 37.

Prehnite.	$H_2Ca_2Al_2(SiO_4)_3$.	Orthorhombic.
Uigite.		
Harstigite.	$H_4Ca_5Mn_2Al_2(SiO_4)_6$.	Orthorhombic.

Group 38.

Cuspidine.	Ca_3FSiO_4(?).	Monoclinic.

Group 39.

Prolectite.	$Mg[Mg(F,OH)]_2SiO_4$.	Monoclinic.
Chondrodite.	$Mg_3[Mg(F,OH)]_2(SiO_4)_2$.	Monoclinic.
Humite.	$Mg_5[Mg(F,OH)]_2(SiO_4)_3$.	Orthorhombic.
Clinohumite.	$Mg_7[Mg(F,OH)]_2(SiO_4)_3$.	Monoclinic.

	Group 40.	
Ilvaite.	$CaFe_2(FeOH)(SiO_4)_2$.	Orthorhombic.
	Group 41.	
Ardennite.	$H_5Mn_4Al_4VSi_4O_{23}$.	Orthorhombic.
	Group 42.	
Bertrandite.	$H(GlOH)Gl_3(SiO_4)_2$.	Orthorhombic.
Calamine.	$H(ZnOH)ZnSiO_4$.	Orthorhombic.
Clinohedrite.	$H(ZnOH)CaSiO_4$.	Monoclinic.
	Group 43.	
Lawsonite.	$H_2Ca(AlOH)_2(SiO_4)_2$.	Orthorhombic.
Carpholite.	$H_2Mn(AlOH)_2(SiO_4)_2$.	Monoclinic.
	Group 44.	
Cerite.	$H_6Ce(CeO)_3(SiO_4)_3$	Orthorhombic.
	Group 45.	
Tourmaline.		Hexagonal; rhombohedral.
Lithia tourmaline.	$H_8(Na,Li)_4Al_{16}B_6Si_{12}O_{63}$.	
Magnesium tourmaline.	$H_8(Mg,Na_2)_{10}Al_{10}B_6Si_{12}O_{63}$.	
Iron tourmaline.	$H_8Na_2Fe_4Al_{14}B_4Si_{12}O_{62}$.	
	Group 46.	
Axinite.	$AlCa_2(AlOH)(BO_3)Si_4O_{12}$.	Triclinic
	Group 47.	
Cappelinite.	$3BaSiO_3.2Y_2(SiO_3)_3.5YBO_3$.	Hexagonal.
Melanocerite	$12(H_2,Ca)SiO_3.3(Y,Ce)BO_3.2H_2(Th,Ce)O_2F_2.8(Ce,La,Di)OF$.	Hexagonal; rhombohedral.
Caryocerite.	$6(H_2,Ca)SiO_3.2(Ce,Y)BO_3.3H_2(Ce,Th)O_2F_2.2LaOF$.	Hexagonal; rhombohedral.
Steenstrupine.		
Tritomite.	$2(H_2,Na_2,Ca)SiO_3.(Ce,La,Di,Y)BO_3.H_2(Ce,Th)O_2F_2$.	Hexagonal; rhombohedral.
	Group 48.	
Kornerupine.	$Mg(AlO)SiO_4$.	Orthorhombic.
Dumortierite.	$Al_2(AlO)_6(SiO_4)_3$.	Orthorhombic.
Staurolite.	$Fe(Al,OH)(AlO)_4(SiO_4)_2$.	Orthorhombic.
Nordmarkite.		
Xantholite.		
Zunyite.	$Al_2[Al(OH,Cl,F)_2]_6(SiO_4)_3$.	Isometric; tetrahedral.
	Group 49.	
Sapphirine.	$Mg_5Al_{12}Si_2O_{27}$.	Monoclinic.

THE ZEOLITES.

The zeolites—groups 50 to 61—are silicates of aluminum with sodium and calcium chiefly, less often strontium and barium. They are all secondary minerals, all yield water upon ignition, and occur most commonly in cavities and seams of the more basic eruptive rocks. With them are included three groups, 62 to 64, of minerals which, though not true zeolites, are similar to them in general structure and occurrence.

Group 50.

Mordenite.	$H_2CaAl_2(Si_2O_5)_5.6H_2O$.	Monoclinic.
Ptilolite.	$H_2(Ca,Na_2,K_2)(Si_2O_5)_5.6H_2O$.	Monoclinic (?).

Group 51.

Analcite.	$Na_2Al_2(SiO_3)_4.2H_2O$.	Isometric.
Euthallite.		
Eudnophite.		

Group 52.

Laumontite.	$CaAl_2(SiO_3)_4.4H_2O$.	Monoclinic.
Caporcianite.		
Leonhardite.		

Group 53.

Gonnardite.	$(Ca,Na_2)_2Al_2(SiO_3)_5.5\frac{1}{2}H_2O$.	Orthorhombic (?).
Laubanite.	$Ca_2Al_2(SiO_3)_5.6H_2O$.	Monoclinic.

Group 54.

Faujasite.	$H_2(Na_2,Ca)Al_2(SiO_3)_5.9H_2O$.	Isometric.
Erionite.	$H_2Ca(Na_2,K_2)Al_2(SiO_3)_6.5H_2O$.	Orthorhombic (?).

Group 55.

Brewsterite.	$(Sr,Ba,Ca)_3Al_6(Si_3O_8)_6.9H_2O$.	Monoclinic.
Heulandite.	$Ca_3Al_6(Si_3O_8)_6.16H_2O$.	Monoclinic.
Oryzite.		
Epistilbite.	$Ca_3Al_6(Si_3O_8)_6.16H_2O$.	Monoclinic.
Stilbite.	$Ca_3Al_6(Si_3O_8)_6.18H_2O$.	Monoclinic.

Group 56.

Phillipsite.	$Ca_2(Na,K)_2Al_6(SiO_4)_3(Si_3O_8).14H_2O$.	Monoclinic.
Harmotome.	$Ba_3Al_6(SiO_4)_3(Si_3O_8).14H_2O$.	Monoclinic.

Group 57.

Gmelinite.	$Na_3Al_3(SiO_4)(Si_3O_8)_2.9H_2O$.	Hexagonal; rhombohedral.
Levynite.	$Ca_3Al_6(SiO_4)_3(Si_3O_8)_3.15H_2O$.	Hexagonal; rhombohedral.
Chabazite.	$Ca_3Al_6(SiO_4)_3(Si_3O_8)_3.18H_2O$.	Hexagonal; rhombohedral.
Phacolite.		
Acadialite.		
Haydenite.		

Group 58.

Thomsonite.	$(Ca,Na_2)_3Al_6(SiO_4)_6.7H_2O$.	Orthorhombic.
Picrothomsonite.		
Lintonite.		
Chlorastrolite.		
Gismondite.	$Ca_3Al_6(SiO_4)_6.12H_2O$.	Monoclinic.

Group 59.

Hydronephelite.	$HNa_2Al_3(SiO_4)_3.3H_2O$.	Hexagonal.
Ranite.		

Group 60.

Natrolite.	$H_4NaAl_2(SiO_4)_3$.	Orthorhombic and monoclinic.
Scolecite.	$H_4CaAl_2(SiO_4)_3.H_2O$.	Monoclinic.
Mesolite.	$H_8CaNa_2Al_4(SiO_4)_6.H_2O$.	Monoclinic and triclinic.
Foresite.	$H_{10}CaNaAl_4(SiO_4)_6.H_2O$.	Monoclinic.
Wellsite.	$H_4(Ba,Ca,K_2)Al_2(SiO_4)_3.H_2O$.	Monoclinic.
Edingtonite.	$H_4BaAl_2(SiO_4)_3.H_2O$.	Orthorhombic.

Group 61.

Offretite.	$H_2Ca_2Al_6(SiO_4)_6.16H_2O$.	(?)

Group 62.

Apophyllite.	$H_{12}Ca_2(CaOH)_2(Si_2O_7)_3$.	Tetragonal.

Group 63.

Okenite.	$H_8Ca_2(Si_2O_7)_2$.	Orthorhombic (?).
Centralassite.		
Xonotlite.		
Gyrolite.	$H_{10}Ca_4(Si_2O_7)_3$.	(?)

Group 64.

Plombierite	$H_2Ca_2Si_2O_7.3H_2O$.	(?)
Inesite.	$H_2(Mn,Ca)_2Si_2O_7.3H_2O$.	Triclinic.

THE MICAS.

The minerals included in groups 65 to 68 all possess a characteristic structure, having a highly perfect basal cleavage, readily affording thin laminæ. They are silicates of aluminum, with potassium, sodium, iron, and magnesium chiefly, and all yield water upon ignition.

Group 65. The Micas.

Muscovite.	$H_2KAl_3(SiO_4)_3$.	Monoclinic.
Damourite.		
Margarodite.		
Fuchsite.		
Avalite.		
Oellacherite.		
Euphyllite.		
Mariposite.		

Group 65—Continued.

Paragonite.	$H_2NaAl_3(SiO_4)_3$.	Monoclinic.
Cossaite.		
Oncosine.		
Lepidolite.	$(Li,K)_2Al_2(F,OH)_2Si_3O_9$.	Monoclinic.
Cookeite.		
Alurgite.		
Zinnwaldite.	$(Li,K)_3FeAl_3(F,OH)_2Si_6O_{16}$.	Monoclinic.
Polylithionite.		
Protolithionite.		
Cryophyllite.	$H_3F_4(Li,K)_7FeAl_4Si_{10}O_{30}$.	Monoclinic.
Biotite.	$HK(Mg,Fe)_2(Al,Fe)_2(SiO_4)_3$.	Monoclinic.
Meroxene.		
Haughtonite.		
Lepidomelane		
Siderophyllite.		
Barytbiotite.		
Rastolyte.		
Phlogopite.	$H_2KMg_3Al_2(SiO_4)_3$.	Monoclinic.
Aspidolite.		
Manganophyllite.		
Ganophyllite.		
Caswellite.		
Rubellan.		
Voigtite.		
Bastonite.		
Pholidolite.		
Roscoelite.	$H_8K_2(Mg,Fe)(Al,V)_4(SiO_4)_3$.	Monoclinic.

Group 66. The Brittle Micas.

Margarite.	$HCa(AlO)_3AlOH(SiO_4)_2$.	Monoclinic.
Seybertite.	$H_3(Mg,Ca)_5Al_5Si_2O_{18}$.	Monoclinic.
Brandisite.	$H_8(Mg,Ca)_{12}Al_{12}Si_5O_{44}$.	Monoclinic.
Xanthophyllite.	$H_8(Mg,Ca)_{14}Al_{16}Si_5O_{52}$.	Monoclinic.
Chloritoid.	$HFe(AlOH)AlO_2SiO_4$.	Monoclinic.
Sismondine.		
Salmite.		
Masonite.		
Ottrelite.	$HFe(AlOH)AlO_2Si_3O_8$.	Monoclinic.
Venasquite.		
Phyllite.		

Group 67. The Vermiculites.

Jefferisite.	$H_{12}Mg_4(Al,Fe)_4Si_5O_{26}$.	Monoclinic.
Pelhamite.		
Vermiculite.		
Kerrite.		
Culsageeite.	$H_4Mg_3(Al,Fe)_2Si_3O_{14}$.	Monoclinic.
Lucasite.	$H_7Mg_7(Al,Fe)_5Si_2O_{32}$.	Monoclinic.
Hallite.	$H_{24}Mg_{12}(Al,Fe)_4Si_9O_{48}$.	Monoclinic.
Painterite.		
Philadelphite.		
Protovermiculite.	$H_2Mg_3(Al,Fe)_2Si_3O_{13}$.	Monoclinic.

Group 67—Continued.

Vaalite.	$H_{24}(Mg,Fe,Ca)_{10}Al_6Si_8O_{50}$.	Monoclinic.
Maconite.		
Dudleyite.		
Pyrosclerite.		
Roseite.		
Willcoxite.		

Group 68. The Chlorites.

Clinochlore.	$H_8(Mg,Fe)_5Al_2Si_3O_{18}$.	Monoclinic
Leuchtenbergite.		
Kotschubeite.		
Penninite.	$H_8(Mg,Fe)_5Al_2Si_3O_{18}$.	Monoclinic.
Kämmererite.		
Loganite.		
Pseudophite.		
Tabergite.		
Prochlorite.	$H_{40}(Mg,Fe)_{23}Al_{14}Si_{13}O_{90}$.	Monoclinic.
Grengesite.		
Grochauite.		
Corundophilite.	$H_{20}(Mg,Fe)_{11}Al_8Si_6O_{45}$.	Monoclinic.
Amesite.		
Daphnite.	$H_{46}Fe_{27}Al_{24}Si_{18}O_{121}$.	Monoclinic.
Metachlorite.		
Klementite.		
Diabantite.	$H_{18}(Mg,Fe)_{12}Al_4Si_9O_{45}$.	Monoclinic (?).
Aphrosiderite.	$H_{10}(Fe,Mg)_6Al_4Si_4O_{25}$.	(?)
Delessite.	$H_{10}(Mg, Fe)_4Al_4Si_4O_{23}$.	(?)
Rumpfite.	$H_{28}Mg_7Al_{16}Si_{14}O_{65}$.	(?)
Cronstedtite.	$H_6(Fe,Mg)_3Fe_2Si_2O_{14}$.	Hexagonal; rhombohedral.
Thuringite.	$H_{18}Fe_8(Al,Fe)_8Si_6O_{41}$.	(?)
Chamosite.		
Stilpnomelane.	$H_3(FeOH)_2AlSi_4O_{14}$.	Hexagonal.
Chalcodite.		
Strigovite.	$H_4(Fe,Mn)_2(Fe,Al)_2Si_2O_{11}$.	Hexagonal.

THE SERPENTINE AND TALC GROUPS.

Group 69.

Serpentine.	$H_3(MgOH)Mg_2(SiO_4)_2$.	Monoclinic.
Bowenite.		
Retinalite.		
Metaxite.		
Williamsite.		
Antigorite.		
Marmolite.		
Chrysotile.		
Picrolite.		
Baltimorite.		
Totaigite.		
Metaxoite.		
Hydrophite.		

Group 70.

Deweylite.	$H_6(MgOH)_2Mg_2(SiO_4)_3.2H_2O$.	(?)
Irongymnite.		
Cerolite.		
Limbachite.		
Genthite.	$H_6(MgOH)_2(Mg,Ni)_2(SiO_4)_3.4H_2O$.	(?)
Garnierite.		
Pimelite.		
Alipite.		
Refdanskite.		
Röttisite.		
Konnarite.		

Group 71.

Talc.	$H_2Mg_3(SiO_3)_4$.	Orthorhombic or monoclinic.
Steatite.		
Sepiolite.	$H_4Mg_2Si_3O_{10}$.	(?)
Aphrodite.		
Spadaite.	$H_3Mg_5(Si_2O_7)_3$.	(?)
Saponite.	$H_4(MgOH)_2Si_2O_7$.	(?)
Celadonite.		
Glauconite.		
Pholidolite.		

THE KAOLINS.

The minerals included in groups 72 to 75 are all earthy aluminous silicates yielding water upon ignition, and as a rule result from the decomposition of other aluminous minerals. With them is included a group of hydrated silicates of iron and manganese which, like the kaolins, are derived mainly from the breaking down of other minerals.

Group 72.

Kaolinite.	$H_3Al(AlOH)(SiO_4)_2$.	Monoclinic.
Rectorite.		
Leverrierite.		
Kaolin.		
Halloysite.	$H_3Al(AlOH)(SiO_4)_2.H_2O$.	(?)
Bole.		
Montmorillonite.	$H_6(AlOH)(SiO_4)_2.(H_2O)_n$.	(?)
Razoumovskin.		
Severite.		
Newtonite.	$H_3Al(OH)_2SiO_4.H_2O$.	Hexagonal; rhombohedral.

Group 73.

Pyrophyllite.	$HAl(SiO_3)_2$.	Orthorhombic(?).
Agalmatolite.		
Pagodite.		
Gümbelite.		
Neurolite.		
Biharite.		

Group 74.

Allophane.	$Al_2SiO_5.5H_2O$.	(?)
Carolathine.		
Samoite.		
Cimolite.	$Al_4(Si_3O_8)_3.6H_2O$.	(?)
Collyrite.	$Al_4Si_3O_8.9H_2O$.	(?)
Dillnite.		
Schrötterite.	$Al_{16}Si_3O_{30}.30H_2O$.	(?)
Scarbroite.		
Sinopite.		
Melinite.		
Ochran.		
Plinthite.		
Smectite.		
Rhodalite.		
Sphragidite.		
Portite.		
Catlinite.		

Group 75.

Chloropal.	Hydrated silicates of iron.
Nontronite.	
Pinguite.	
Graminite.	
Glasurite.	
Protonontronite.	
Anthosiderite.	
Hisingerite.	
Degeröite.	
Scotiolite.	
Gillingite.	
Jollyite.	
Melanosiderite.	
Avasite.	
Hydrotephroite.	Hydrated silicates of manganese.
Neotocite.	
Klipsteinite.	
Penwithite.	

Group 76.

Silicates with carbonates, sulphates, and sulphites.

Cenosite.	$Ca(Y,Er)_2(SiO_3)_4.CaCO_3.2H_2O$.	Orthorhombic (?).
Thaumasite.	$CaSiO_3.CaSO_4.CaCO_3.15H_2O$.	Tetragonal.
Rœblingite.	$5H_2CaSiO_4.2CaPbSO_4$.	(?)

Group 77.

Silicates containing Uranium.

Uranophane.	$CaU_2Si_2O_{11}.5H_2O$.	Orthorhombic.
Gummite.	$(Pb,Ca,Ba)U_3SiO_{12}.5H_2O$.	(?)
Coracite.		

OXYGEN SALTS: CLASS,—TITANATES.

The titanates, derivatives of H_2TiO_3 and $H_2Ti_2O_5$, or compounds of oxides with oxides whose negative portion is made up solely or chiefly of titanium oxide, may be arranged under the following types: Titanates, compounds in which the negative portion is titanium oxide; titanosilicates, compounds in which the negative portion is compounded of titanic and silicic oxides; columbotitanates, including those compounds intermediate between the titanates and the succeeding columbates, and whose negative parts may consist of the oxide of titanium with the oxides of columbium, or silicon, with zirconium. etc.

A. TITANATES.

Group 1.

Perovskite.	$CaTiO_3$.	Isometric.
Knopite.		
Geikielite.	$MgTiO_3$.	Hexagonal; rhombohedral.
Pyrophanite.	$MnTiO_3$.	Hexagonal; rhombohedral.
Ilmenite.	$FeTiO_3$.	Hexagonal; rhombohedral.
Menaccanite.		
Kibdelophane.		
Crichtonite.		
Hystatite.		
Uddevallite.		
Basanomelane.		
Picrotitanite.		
Hydroilmenite.		

Group 2.

Pseudobrookite.	$Fe_4(TiO_4)_3$.	Orthorhombic.

Group 3.

Derbylite.	$5FeTiO_3.Fe(SbO_3)_2$.	Orthorhombic.
Lewisite.	$2(Ca,Fe)TiO_3.3Ca(SbO_3)_2$.	Isometric.

B. TITANOSILICATES

Group 1.

Titanite.	$CaTiSiO_5$.	Monoclinic.
Titanomorphite.		
Ligurite.		
Grothite.		
Eucolite titanite.		
Zirkelite.		
Alshedite.		
Xanthitane.		
Neptunite.	$(Fe,Mn)TiSiO_5$.	Monoclinic.
Keilhauite.	$Ca(Y,Al)(Y,Al,Fe)[(SiTiO_5)(SiO_5)]$.	Monoclinic.
Tscheffkinite.	$(Fe,Ce,La,Di)_2(Ca,Fe,Gl)_2(SiTiO_5)_3$.	(?)

Group 2.

Johnstrupite.	$H_2Na_6(Ca,Mg)_{13}(Ce,Y,Al,Fe)F_6(Ti,Zr)_3Si_{12}O_{48}$.	Monoclinic.
Mosandrite.	$H_{12}Na_2Ca_{10}(Ce,Y)(OH,F)_8(Ti,Zr,Ce)_4Si_{12}O_{48}$.	Monoclinic.
Rinkite.	$Na_9Ca_{11}Ce_3F_8Ti_4Si_{12}O_{48}$.	Monoclinic.

Group 3.

Astrophyllite.	$(H,Na,K)_4(Fe,Mn)_4(Si,Ti)_5O_{16}$.	Orthorhombic.

C. COLUMBOTITANATES.

Group 1.

Dysanalyte.	$Na_2(Ca,Fe)_8Ti_{10}O_{29}Ce(CbO_3)_3$.	Isometric.
Hydrotitanite.		
Polymignite.	$Ce_4(Ca,Fe)_4(Ti,Zr)_{10}O_{29}Ca(CbO_3)_2$.	Orthorhombic.
Æschynite.	$Ce_2(Ca,Fe)_2(Ti,Th)_8O_{21}Ce_2(CbO_3)_8$.	Orthorhombic.
Polycrase.	$(Ca,Fe)_4Y_4(UO_2)Ti_{12}O_{35}Y_2(CbO_3)_6$.	Orthorhombic.
Euxenite.	$Fe(Y,Er,Ce)_2(UO)(Ti_2O_5)_6$. $Fe(Y,Er,Ce)_2(UO)(CbO_3)_2$.	Orthorhombic.

OXYGEN SALTS: CLASS,—COLUMBATES AND TANTALATES.

The columbates and tantalates are derivatives of columbic and tantalic acids, H_3RO_4, $H_4R_2O_7$, and HRO_3, or compounds of oxides with oxides whose negative parts are taken by the oxides of columbium or tantalum. The intimate relations existing between these compounds require them to be grouped together, there being in fact but few native tantalates that do not contain more or less columbium. In the formulas R = the oxides of the rare earths and uranium, calcium, iron, etc.

Group 1.

Pyrochlore.	$RCb_2O_5.R(Ti,Th)O_3.NaF$.	Isometric.
Koppite.	$5R_2Cb_2O_7.2NaF$.	Isometric.
Hatchettolite.	$2R(Cb,Ta)_2O_6.R_2(Cb,Ta)_2O_7$.	Isometric.
Microlite.	$[R_2(Ta,Cb)_2O_7.2R(Ta,Cb)_2O_6].NaF$.	Isometric.
Pyrrhite.		

Group 2.

Yttrotantalite.	$\overset{ii}{R}_2\overset{iii}{R}_2(Ta,Cb)_4O_{15}$.	Orthorhombic.
Samarskite.	$\overset{ii}{R}_3\overset{iii}{R}_2(Cb,Ta)_6O_{21}$.	Orthorhombic.
Nohlite.		
Blomstrandite.		
Vietinghofite.		
Annerödite.		
Rogersite.		
Hjelmite.	$R_4Ta_6O_{19}(?)$.	Orthorhombic.

Group 3.

Fergusonite.	$(Y,Er,Ce)(Cb,Ta)O_4$.	Tetragonal.
Rutherfordite.		
Kochelite.		
Arrhenite.		
Sipylite.	$ErCbO_4$.	Tetragonal.

Group 4.

Columbite.	$Fe(CbO_3)_2$.	Orthorhombic.
Manganocolumbite.		
Tantalite.	$Fe(TaO_3)_2$.	Orthorhombic.
Manganotantalite.		
Tapiolite.	$(Fe,Mn)[(Cb,Ta)O_3]_2$.	Tetragonal.
Mossite.		
Adelpholite.		

OXYGEN SALTS: CLASS,—NITRATES.

The nitrates, derivatives of HNO_3, or compo nds of oxides with oxides whose negative portion is nitrogen pentoxide, are few and are chiefly salts of sodium, potassium, calcium, and magnesium. There is a single basic cuprous species and a few double salts.

Group 1.

Soda niter.	$NaNO_3$.	Hexagonal; rhombohedral.
Niter.	KNO_3.	Orthorhombic.
Nitrobarite.	$Ba(NO_3)_2$.	Isometric.

Group 2.

Nitrocalcite.	$Ca(NO_3)_2.4H_2O$.	(?)
Nitromagnesite.	$Mg(NO_3)_2.6H_2O$.	(?)

Group 3.

Gerhardtite	$Cu_4(OH)_6(NO_3)_2$.	Orthorhombic.

Group 4.

Darapskite.	$NaNO_3.Na_2SO_4.H_2O$	Monoclinic.
Nitroglauberite.		

OXYGEN SALTS: CLASS,—VANADATES.

The vanadates, derivatives of H_3VO_4, include those minerals in which vanadium pentoxide constitutes the negative portion. The principal vanadates are vanadinite, a combination of a lead vanadate and chloride, and descloizite, a basic lead vanadate carrying zinc.

Group 1.

Pucherite.	$BiVO_4$.	Orthorhombic.

Group 2.

Vanadinite.	$(PbCl)Pb_4(VO_4)_3$.	Hexagonal.
Endlichite.	$\begin{bmatrix}(PbCl)Pb_4(VO_4)_3. \\ (PbCl)Pb_4(AsO_4)_3.\end{bmatrix}$	Hexagonal.

Group 3.

Descloizite.	$(Pb,Zn)_2(OH)VO_4$.	Orthorhombic.
Cuprodescloizite.		
Eusynchite.		
Dechenite.		
Calciovolborthite.	$(Cu,Ca)_2(OH)VO_4$.	Orthorhombic.

Group 4.

Brackebuschite.	$(Pb,Fe,Mn)_3(VO_4)_2.H_2O$.	Monoclinic(?).

Group 5.

Psittacinite.	$(Pb,Cu)_4(OH)_2(VO_4)_2.H_2O$.	(?)
Mottramite.		
Chileite.		
Vanadiolite.		
Volborthite.	$(Cu,Ca,Ba)_3(OH)_3VO_4.6H_2O$.	(?)

OXYGEN SALTS: CLASS,—PHOSPHATES.

The phosphates, derivatives of H_3PO_4, $H_4P_2O_7$, and HPO_3, include the native oxidized compounds of phosphorus, which are compounds of oxides with phosphorus pentoxide. These compounds are either normal or basic salts, both hydrous and anhydrous. The phosphates may crystallize with a fluoride, as in apatite, a combination of a phosphate and fluoride; with a chloride, as in pyromorphite, a combination of a phosphate and chloride, or with a hydroxyl, as in triploidite.

Group 1.

Monetite.	$HCaPO_4$.	Triclinic.
Natrophite.		
Pyrophosphorite.		

Group 2.

Triphylite.	$Li(Fe,Mn)PO_4$.	Orthorhombic.
Heterosite.		
Melanchlor.		
Lithiophilite.	$Li(Mn,Fe)PO_4$.	Orthorhombic.
Natrophilite.	$NaMnPO_4$.	Orthorhombic.
Beryllonite.	$NaGlPO_4$.	Orthorhombic.

Group 3.

Xenotime.	$(Y,Ce)PO_4$.	Tetragonal.
Monazite.	$(Ce,La,Di,Th)PO_4$.	Monoclinic.
Kårarfveite.		

Group 4.

Apatite.	$(CaF)Ca_4(PO_4)_3$.	Hexagonal.
Chlorapatite.		
Manganapatite.		
Cuproapatite.		
Phosphorite.		
Coprolite.		
Staffelite.		
Epiphosphorite.		
Hydroapatite.		

Group 4—Continued.

Pyromorphite.	$(PbCl)Pb_4(PO_4)_3$.	Hexagonal.
Polysphærite.		
Cherokine.		
Miesite.		
Nussierite.		

Group 5.

Amblygonite.	$Li(AlF)PO_4$.	Triclinic.
Montebrasite.	$Li(AlOH)PO_4$.	Triclinic.
Morinite.		

Group 6.

Spodiosite.	$(CaF)CaPO_4$.	Orthorhombic.
Herderite.	$[Ca(OH,F)]GlPO_4$.	Monoclinic.
Wagnerite.	$(MgF)MgPO_4$.	Monoclinic.
Kjerulfine.		
Cryphiolite.		
Triplite.	$[(Fe,Mn)F](Fe,Mn)PO_4$.	Monoclinic.
Sarcopside.	Alteration products of triplite.	
Pseudotriplite.		
Alluaudite.		
Griphite.		
Triploidite.	$[(Mn,Fe)OH](Mn,Fe)PO_4$.	Monoclinic.

Group 7.

Libethenite.	$Cu_2(OH)PO_4$.	Orthorhombic.
Pseudomalachite.	$Cu_3(OH)_3PO_4$.	(?)
Dihydrite.	$Cu_6(OH)_4(PO_4)_2$.	Monoclinic or triclinic.

Group 8.

Dufrenite.	$Fe_2(OH)_3PO_4$.	Orthorhombic.
Augelite.	$Al_2(OH)_3PO_4$.	Monoclinic.
Trolleite.	$Al_4(OH)_3(PO_4)_3$.	(?)
Attacolite.		

Group 9.

Cirrolite.	$Ca_3Al_2(OH)_3(PO_4)_3$.	(?)
Tavistockite.	$Ca_3Al_2(OH)_6(PO_4)_2$.	(?)
Lazulite.	$(Fe,Mg)Al_2(OH)_2(PO_4)_2$.	Monoclinic.
Tetragophosphite.		
Andrewsite.	$(Cu,Fe,Mn)Fe_4(OH)_7(PO_4)_3$ (?)	(?)

Group 10.

Hamlinite.	$(Sr,Ba)Al_3(OH,F)_7P_2O_7$.	Hexagonal; rhombohedral.

Group 11.

Struvite.	$NH_4MgPO_4.6H_2O$.	Orthorhombic.
Guanapatite.	Guano minerals.	
Epiglaubite.		
Dittmarite.		
Redondite.		

Group 12.

Colophanite.	$Ca_3(PO_4)_2.H_2O$.	(?)
Monite.		
Dickinsonite.	$(Mn,Fe,Ca,Na_2)_3(PO_4)_2.\frac{1}{3}H_2O$.	Monoclinic.
Fillowite.	$(Mn,Fe,Ca,Na_2)_3(PO_4)_2.\frac{1}{3}H_2O$.	Monoclinic.
Fairfieldite.	$(Ca,Fe,Mn)_3(PO_4)_2.2H_2O$.	Triclinic.
Messelite.	$(Ca,Fe)_3(PO_4)_2.2\frac{1}{2}H_2O$.	Triclinic.
Reddingite.	$Mn_3(PO_4)_2.3H_2O$.	Orthorhombic.
Hopeite.	$Zn_3(PO_4)_2.4H_2O$.	Orthorhombic.

Group 12 A.

Bobierrite.	$Mg_3(PO_4)_2.8H_2O$.	Monoclinic.
Hautefeuillite.	$(Mg,Ca)_3(PO_4)_2.8H_2O$.	Monoclinic.
Vivianite.	$Fe_3(PO_4)_2.8H_2O$.	Monoclinic.

Group 13.

Rhabdophanite.	$(La,Di,Y,Er)PO_4.2H_2O$.	(?)
Scovillite.		
Churchite.	$CePO_4.2H_2O$.	Monoclinic (?)
Variscite.	$AlPO_4.2H_2O$.	Orthorhombic.
Planerite.		
Barrandite.	$(Al,Fe)PO_4.2H_2O$.	(?)
Strengite.	$FePO_4.2H_2O$.	Orthorhombic.
Callainite.	$AlPO_4.2\frac{1}{2}H_2O$.	(?)
Berlinite.		
Amphithalite.		
Zepharovichite.	$AlPO_4.3H_2O$.	(?)
Koninckite.	$FePO_4.3H_2O$.	(?)
Minervite.	$AlPO_4.3\frac{1}{2}H_2O$.	Orthorhombic.
Phosphosiderite.	$2FePO_4.3\frac{1}{2}H_2O$.	Orthorhombic.

Group 14.

Stercorite.	$H(NH_4)NaPO_4.4H_2O$.	Monoclinic.
Hannayite.	$H_4(NH_4)_2Mg_3(PO_4)_4.8H_2O$.	Triclinic.

Group 15.

Newberyite.	$HMgPO_4.3H_2O$.	Orthorhombic.
Brushite.	$HCaPO_4.2H_2O$.	Monoclinic.
Metabrushite.		
Martinite.	$H_2Ca_5(PO_4)_4.\frac{1}{2}H_2O$.	Hexagonal; rhombohedral.
Zeugite.		
Hureaulite.	$H_2Mn_5(PO_4)_4.4H_2O$.	Monoclinic.

Group 16.

Henwoodite.	$H_{10}CuAl_4(PO_4)_8.6H_2O$.	(?)

Group 17.

Pseudolibethenite.	$Cu_2(OH)PO_4.\frac{1}{2}H_2O$.	(?)
Tagilite.	$Cu_2(OH)PO_4.H_2O$.	Monoclinic.
Isoclasite.	$Ca_2(OH)PO_4.2H_2O$.	Monoclinic (?).
Ehlite.	$Cu_5(OH)_4(PO_4)_2.H_2O$.	(?)
Ludlamite.	$Fe_7(OH)_2(PO_4)_4.8H_2O$.	Monoclinic.
Veszelyite.	$(Cu,Zn)_4(OH)_8[(As,P)O_4]_2.5H_2O$.	Monoclinic or triclinic.

Group 18.

Wardite.	$Al_2(OH)_3PO_4.\frac{1}{2}H_2O$.	(?)
Turquoise.	$Al_2(OH)_3PO_4.H_2O$.	(?)
Peganite.	$Al_2(OH)_3PO_4.1\frac{1}{2}H_2O$.	Orthorhombic.
Fischerite.	$Al_2(OH)_3PO_4.2\frac{1}{2}H_2O$.	Orthorhombic.
Cacoxenite.	$Fe_2(OH)_3PO_4.4\frac{1}{2}H_2O$.	Monoclinic (?).
Evansite.	$Al_3(OH)_6PO_4.6H_2O$.	(?)
Wavellite.	$Al_3(OH)_3(PO_4)_2.5H_2O$.	Orthorhombic.
Lime Wavellite.		
Taranakite.		
Delvauxite.	$Fe_4(OH)_6(PO_4)_2.17H_2O$.	(?)
Sphærite.	$Al_5(OH)_9(PO_4)_2.12H_2O$.	(?)
Beraunite.	$Fe_5(OH)_6(PO_4)_3.3H_2O$.	(?)
Eleonorite.		
Globosite.		
Picite.		

Group 19.

Childrenite.	$(Fe,Mn)Al(OH)_2PO_4.2H_2O$.	Orthorhombic.
Eosphorite.	$(Mn,Fe)Al(OH)_2PO_4.2H_2O$.	Orthorhombic.
Calcioferrite.	$Ca_3Fe_3(OH)_3(PO_4)_4.8H_2O$.	Orthorhombic.
Borickite.	$CaFe_4(OH)_6(PO_4)_2.4H_2O$.	(?)
Richellite.		

Group 20.

Chalcosiderite.	$CuFe_6P_4O_{20}.8H_2O$.	Triclinic.
Goyazite.	$Ca_3Al_{10}P_2O_{23}.9H_2O$.	Tetragonal or hexagonal.
Hitchcockite.	$PbAl_4P_2O_{12}.9H_2O$.	Hexagonal.
Plumbogummite.		

Group 21.

Phosphates containing uranium.

Phosphuranylite.	$(UO_2)_3(PO_4)_2.6H_2O$.	(?)
Uranocircite.	$(UO_2)_2Ba(PO_4)_2.8H_2O$.	Orthorhombic.
Autunite.	$(UO_2)_2Ca(PO_4)_2.8H_2O$.	Orthorhombic.
Fritzcheite		
Torbernite.	$(UO_2)_2Cu(PO_4)_2.8H_2O$.	Tetragonal.

Group 22.

Phosphates with carbonates, sulphates, and borates.

Dahllite.	$Ca_7CO_3P_4O_{16}.\frac{1}{2}H_2O$.	Hexagonal.
Destinezite.	$Fe_4S_2P_2O_{17}.12H_2O$.	(?)
Diadochite.	$Fe_7S_3P_5O_{27}.27H_2O$.	Monoclinic.
Svanbergite.	$Na_2CaAl_2SP_2O_{13}.H_2O$.	Hexagonal; rhombohedral.
Rhodophosphite.	$Ca(Mn,Fe)SClFP_2O_{16}.H_2O$.	(?)
Beudantite.	$Fe_2CuPbS(P,As)_2O_{12}.H_2O$.	Hexagonal; rhombohedral.
Lünebergite.	$Mg_3B_2P_2O_{11}.8H_2O$.	(?)

OXYGEN SALTS: CLASS,—ARSENATES AND ANTIMONATES.

This class, derivatives of H_3RO_4, H_4RO_7, etc., includes those compounds of oxides with oxides whose negative parts are taken by arsenic pentoxide or antimony pentoxide. They are similar to the phosphates in molecular structure, and, like them, are either normal or basic salts both with and without water of crystallization. Further, they may crystallize with a fluoride, chloride, or hydroxyl. As a class they present many analogies to the phosphates, and like salts, as a rule, are isomorphous.

Group 1.

Cervantite.	$SbSbO_4$.	Orthorhombic.

Group 2.

Berzeliite.	$(Ca,Mg,Mn)_3(AsO_4)_2$.	Isometric.
Pseudoberzeliite.		
Pyrrhoarsenite.		
Monimolite.	$(Pb,Fe,Ca)_3(SbO_4)_2$.	Isometric.
Caryinite.	$(Pb,Mn,Ca,Mg)_3(AsO_4)_2$.	Monoclinic.
Nickelarsenate.	$Ni_3(AsO_4)_2$.	(?)

Group 3.

Carminite	$Fe_{10}Pb_3(AsO_4)_{12}$.	Orthorhombic.

Group 4.

Atopite.	$Ca_2Sb_2O_7$.	Isometric.

Group 5.

Mimetite.	$(PbCl)Pb_4(AsO_4)_3$.	Hexagonal.
Hedyphane.		
Pleonectite.		
Campylite.	$(PbCl)Pb_4[(As,P)O_4]_3$.	Hexagonal.

Group 6.

Durangite.	$Na(AlF)AsO_4$.	Monoclinic.
Fluoradelite.	$Ca(MgF)AsO_4$.	Monoclinic.
Adelite.	$Ca(MgOH)AsO_4$.	Monoclinic.
Sarkinite.	$Mn(MnOH)AsO_4$.	Monoclinic.
Polyarsenite.		

Group 7.

Adamite.	$Zn_2(OH)AsO_4$.	Orthorhombic.
Olivenite.	$Cu_2(OH)AsO_4$.	Orthorhombic.
Chondrarsenite.	$Mn_3(OH)_3AsO_4$(?).	(?)
Clinoclasite.	$Cu_3(OH)_3AsO_4$.	Monoclinic.
Erinite.	$Cu_5(OH)_4(AsO_4)_2$.	(?)

Group 8.

Arseniosiderite.	$Fe_4Ca_3(OH)_9(AsO_4)_3$.	Tetragonal or hexagonal.
Arseniopleite.	$(Fe,Mn)_2(Mn,Ca,Pb)_3(OH)_6(AsO_4)_6$.	(?)

Group 9.

Atelestite.	$Bi(OH)_2(BiO)_2AsO_4$.	Monoclinic.

Group 10.

Manganostibiite.	$Mn_2(Mn_8O_7)(SbO_4)_2$.	Orthorhombic (?).
Hematostibiite.	$(Mn,Fe)_2[(Mn,Fe)_8O_7](SbO_4)_2$.	Orthorhombic (?).
Ferrostibian.		
Stibiatil.		

Group 11.

Flinkite.	$MnAsO_4.2Mn(OH)_2$.	Orthorhombic.
Hematolite.	$(Mn,Al)AsO_4 4.Mn(OH)_2$.	Hexagonal; rhombohedral.
Synadelphite.	$2(Mn,Al)AsO_4.5Mn(OH)_2$.	Monoclinic.
Allactite.	$Mn_3(AsO_4)_2.4Mn(OH)_2$.	Monoclinic.

Group 12.

Bindheimite.	$Pb(SbO_3)_2.2H_2O$.	(?)

Group 13.

Stibiconite.	$SbSbO_4.H_2O$.	(?)
Volgerite.		
Rivotite.		
Stibianite.		
Stibioferrite.		
Partzite.		
Stetfeldite.		

Group 14.

Scorodite.	$FeAsO_4.2H_2O$.	Orthorhombic.
Jogynaite.		
Liskeardite.	$(Fe,Al)AsO_4.8H_2O$.	(?)

Group 15.

Brandtite.	$MnCa_2(AsO_4)_2.2H_2O$.	Triclinic.
Roselite.	$(Ca,Co,Mg)_3(AsO_4)_2.2H_2O$.	Triclinic.
Lavendulan.	$Cu_3(AsO_4)_2.2H_2O$.	(?)
Trichalcite.	$Cu_3(AsO_4)_2.5H_2O$.	(?)
Chlorotile.	$Cu_3(AsO_4)_2.6H_2O$.	Orthorhombic.
Picropharmacolite.	$(Ca,Mg)_3(AsO_4)_2.6H_2O$.	(?)

Group 16.

Hœrnesite.	$Mg_3(AsO_4)_2.8H_2O$.	Monoclinic.
Köttigite.	$Zn_3(AsO_4)_2.8H_2O$.	Monoclinic.
Symplesite.	$Fe_3(AsO_4)_2.8H_2O$.	Monoclinic.
Erythrite.	$Co_3(AsO_4)_2.8H_2O$.	Monoclinic.
Annabergite.	$Ni_3(AsO_4)_2.8H_2O$.	Monoclinic.
Dudgeonite.	$(Ni,Ca)_3(AsO_4)_2.8H_2O$.	Monoclinic.
Cabrerite.	$(Ni,Mg)_3(AsO_4)_2.8H_2O$.	Monoclinic.

Group 17.

Rösslerite.	$HMgAsO_4.\frac{1}{2}H_2O$.	(?)
Haidingerite.	$HCaAsO_4.H_2O$.	Orthorhombic.
Pharmacolite.	$HCaAsO_4.2H_2O$.	Monoclinic.
Wapplerite.	$H(Ca,Mg)AsO_4.3\frac{1}{2}H_2O$.	Triclinic.
Forbesite.	$H(Ni,Co)AsO_4.3\frac{1}{2}H_2O$.	(?)

Group 18.

Conichalcite.	$(Cu,Ca)_2(OH)AsO_4.\frac{1}{4}H_2O$.	(?)
Bayldonite.	$(Cu,Pb)_2(OH)AsO_4.\frac{1}{2}H_2O$.	(?)
Leucochalcite.	$Cu_2(OH)AsO_4.H_2O$.	(?)
Euchroite.	$Cu_2(OH)AsO_4.3H_2O$.	Orthorhombic.

Group 19.

Hemafibrite.	$Mn_3(OH)_3AsO_4.H_2O$.	Orthorhombic.
Xanthoarsenite.	$(Mn,Ca,Mg)_3(OH)_3AsO_4.5H_2O$.	(?)

Group 20.

Chalcophyllite.	$Cu_4(OH)_5AsO_4.3\frac{1}{2}H_2O$.	Hexagonal; rhombohedral.

Group 21.

Cornwallite.	$Cu_5(OH)_4(AsO_4)_2.H_2O$.	(?)
Tyrolite.	$Cu_5(OH)_4(AsO_4)_2.7H_2O$.	Orthorhombic.

Group 22.

Pharmacosiderite.	$Fe_4(OH)_3(AsO_4)_3.6H_2O$.	Isometric; tetrahedral.

Group 23.

Mazapilite.	$Fe_4Ca_3(OH)_6(AsO_4)_4.3H_2O$.	Orthorhombic.

Group 24.

Chenevixite.	$Cu_3(FeO)_2(AsO_4)_2.3H_2O$.	(?)

Group 25.

Liroconite.	$Cu_9Al_4(OH)_{15}(AsO_4)_5.20H_2O$.	Monoclinic.

Group 26.

Arsenates containing uranium and bismuth.

Trögerite.	$(UO_2)_3(AsO_4)_2.12H_2O$.	Monoclinic.
Uranospinite.	$(UO_2)_2Ca(AsO_4)_2.8H_2O$.	Orthorhombic.
Zeunerite.	$(UO_2)_2Cu(AsO_4)_2.8H_2O$.	Tetragonal.
Walpurgite.	$(UO_2)_3Bi_{10}As_4O_{28}.10H_2O$.	Triclinic.
Rhagite.	$Bi(BiO)_9(AsO_4)_4.8H_2O$.	(?)
Mixite.	$BiCu_{10}(OH)_8(AsO_4)_5.7H_2O$.	Monoclinic or triclinic.

Group 27.

Arsenates with sulphates.

Lindackerite.	$Cu_6Ni_3(OH)_4(SO_4)(AsO_4)_4.5H_2O$.	Orthorhombic.
Lossenite.	$PbFe_9(OH)_9(SO_4)(AsO_4)_6.12H_2O$.	Orthorhombic.
Pitticite.	$Fe_{20}(OH)_{24}(SO_4)_3[(As,P)O_4]_{10}.9H_2O$.	(?)

OXYGEN SALTS: CLASS,—SULPHATES.

The sulphates, derivatives of H_2SO_4, or compounds of oxides with oxides in which the sole or principal negative constituent is sulphur trioxide, are either normal or basic salts with and without water of

crystallization. Further, they may crystallize with chlorides or carbonates. The few native tellurates and selenates, derivatives of H_2RO_4 and analogous to the sulphates, are here included.

SULPHATES.

Group 1.

Mascagnite.	$(NH_4)_2SO_4$.	Orthorhombic.
Thenardite.	Na_2SO_4.	Orthorhombic.
Arcanite.	$(Na,K)_2SO_4$.	Orthorhombic.
Taylorite.		
Aphthitalite.	$(K,Na)_2SO_4$.	Hexagonal; rhombohedral.
Glaserite.		

Group 2.

Misenite.	$HKSO_4$.	Monoclinic (?).

Group 3.

Glauberite.	$Na_2Ca(SO_4)_2$.	Monoclinic.
Langbeinite.	$K_2Mg_2(SO_4)_3$.	Isometric; tetrahedral.

Group 4.

Anhydrite.	$CaSO_4$.	Orthorhombic.
Barite.	$BaSO_4$.	Orthorhombic.
Dreelite.		
Celestobarite.	$(Ba,Sr)SO_4$.	Orthorhombic.
Celestite.	$SrSO_4$.	Orthorhombic.
Calciocelestite.		
Zinkosite.	$ZnSO_4$.	Orthorhombic.
Anglesite.	$PbSO_4$.	Orthorhombic.
Sardinianite.		Monoclinic.
Hydrocyanite.	$CuSO_4$.	Orthorhombic.

Group 5.

Linarite.	$(Pb,Cu)_2(OH)_2SO_4$.	Monoclinic.
Brochantite.	$Cu_4(OH)_6SO_4$.	Orthorhombic.
Waringtonite.		
Antlerite.		

Group 6.

Alumian.	$Al(AlO)(SO_4)_2$.	Hexagonal; rhombohedral.

Group 7.

Lanarkite.	$(Pb_2O)SO_4$.	Monoclinic.
Dolerophanite.	$(Cu_2O)SO_4$.	Monoclinic.

Group 8.

Guanovulite.	$(H,K,NH_4)_2(SO_4)_2.2H_2O$.	(?)
Lecontite.	$(Na,NH_4)_2SO_4.2H_2O$.	Orthorhombic.
Mirabilite.	$Na_2SO_4.10H_2O$.	Monoclinic.
Exanthalite.		
Gypsum.	$CaSO_4.2H_2O$	Monoclinic.
Selenite.		
Kieserite.	$MgSO_4.H_2O$.	Monoclinic.
Szmikite.	$MnSO_4.H_2O$.	(?)

Group 9. The vitriols.

α. Orthorhombic section.

Epsomite.	$MgSO_4.7H_2O$.	
Fauserite.	$(Mg,Mn)SO_4.7H_2O$.	
Goslarite.	$ZnSO_4.7H_2O$.	
Ferrogoslarite.		
Tauriscite.	$FeSO_4.7H_2O$.	
Morenosite.	$NiSO_4.7H_2O$.	

β. Monoclinic section

Mallardite.	$MnSO_4.7H_2O$.	
Luckite.	$(Mn,Fe)SO_4.7H_2O$.	
Salvadorite.		
Melanterite.	$FeSO_4.7H_2O$.	
Bieberite.	$CoSO_4.7H_2O$.	
Cupromagnesite.	$(Cu,Mg)SO_4.7H_2O$.	
Pisanite.	$(Cu,Fe)SO_4.7H_2O$.	

Group 9A.

Chalcanthite.	$CuSO_4.5H_2O$.	Triclinic.
Manganotile.	$MnSO_4.5H_2O$.	(?)
Siderotile.	$FeSO_4.5H_2O$.	(?)
Ilesite.	$(Mn,Fe,Zn)SO_4.4H_2O$.	Monoclinic.
Serpierite.	$(Cu,Zn,Ca)SO_4.3H_2O$.	Orthorhombic.

Group 10.

Langite.	$Cu_6(OH)_6SO_4.H_2O$.	Orthorhombic.
Herrengrundite	$Cu_4Ca(OH)_6(SO_4)_2.3H_2O$.	Monoclinic.
Arnimite.	$Cu_5(OH)_6(SO_4)_2.3H_2O$.	Monoclinic.
Kamerezite.	$Cu_3(OH)_4SO_4.6H_2O$.	Orthorhombic.

Group 11.

Coquimbite.	$Fe_2(SO_4)_3.9H_2O$.	Hexagonal; rhombohedral.
Kornelite.		
Quenstedtite.	$Fe_2(SO_4)_3.10H_2O$.	Monoclinic.
Ihleite.	$Fe_2(SO_4)_3.12H_2O$.	(?)
Alunogen.	$Al_2(SO_4)_3.18H_2O$.	Monoclinic
Davite.		
Tekticite.		

Group 12.

Rubrite.	$Fe(OH)SO_4.H_2O$.	(?)
Amarantite.	$Fe(OH)SO_4.3H_2O$.	Triclinic.
Hohmannite.		
Castanite.	$Fe(OH)SO_4.4H_2O$.	Monoclinic.
Fibroferrite.	$Fe(OH)SO_4.5H_2O$.	Monoclinic (?).
Aluminite.	$Al_2(OH)_4SO_4.7H_2O$.	Monoclinic.
Werthemannite.		
Winebergite.		
Planoferrite.	$Fe_2(OH)_4SO_4.13H_2O$.	Orthorhombic (?).
Raimondite.	$Fe_4(OH)_6(SO_4)_3.4H_2O$.	Hexagonal.
Pastreite.		

Group 12—Continued.

Paposite.	$Fe_4(OH)_6(SO_4)_3.7H_2O$.	Monoclinic or triclinic.
Carphosiderite.	$Fe_6(OH)_{10}(SO_4)_4.4H_2O$.	Hexagonal.
Copiapite.	$Fe_3(OH)_2(SO_4)_5.18H_2O$.	Monoclinic.
Apatelite.		
Glockerite.	$Fe_4(OH)_{10}SO_4.H_2O$.	Orthorhombic.
Felsöbanyite.	$Al_4(OH)_{10}SO_4.5H_2O$.	Orthorhombic.
Paraluminite.	$Al_4(OH)_{10}SO_4 10H_2O$.	(?)
Utahite.	$(FeO)_2SO_4.1\frac{1}{3}H_2O$.	Hexagonal; rhombohedral.
Cyprusite.	$Al(FeO)_7(SO_4)_5.7H_2O$.	Hexagonal; rhombohedral.

Group 13.

Syngenite.	$CaK_2(SO_4)_2.H_2O$.	Monoclinic.
Wattevillite.	$(Ca,Mg)(Na,K)_2(SO_4)_2.2H_2O$.	Monoclinic (?).
Kröhnkite.	$CuNa_2(SO_4)_2.2H_2O$.	Monoclinic.
Löweite.	$MgNa_2(SO_4)_2.2\frac{1}{2}H_2O$.	Tetragonal.
Blödite.	$MgNa_2(SO_4)_2.4H_2O$.	Monoclinic.
Simonyite.		
Leonite.	$MgK_2(SO_4)_2.4H_2O$.	(?)
Boussingaultite.	$Mg(NH_4)_2(SO_4)_2.6H_2O$.	Monoclinic.
Picromerite.	$MgK_2(SO_4)_2.6H_2O$.	Monoclinic.
Cyanochroite.	$CuK_2(SO_4)_2.6H_2O$.	Monoclinic.
Polyhalite.	$Ca_2MgK_2(SO_4)_4.2H_2O$.	Monoclinic (?).
Mamanite.		
Krugite.	$Ca_4MgK_2(SO_4)_6.2H_2O$.	(?)

Group 14.

Tschermigite.	$AlNH_4(SO_4)_2.12H_2O$.	Isometric.
Kalinite.	$AlK(SO_4)_2.12H_2O$.	Isometric.
Mendozite.	$AlNa(SO_4)_2.12H_2O$.	(?)
Tamarugite.	$AlNa(SO_4)_2.6H_2O$.	(?)
Pickeringite.	$Al_2Mg(SO_4)_4.22H_2O$.	Monoclinic (?).
Stüvenite.	$Al_2(Mg,Na_2)(SO_4)_4.24H_2O$.	(?)
Seelandite.	$Al_2Mg(SO_4)_4.27H_2O$.	(?)
Halotrichite.	$Al_2Fe(SO_4)_4.24H_2O$.	Monoclinic or triclinic.
Apjohnite.	$Al_2Mn(SO_4)_4.24H_2O$.	Monoclinic (?).
Bushmannite.		
Dietrichite.	$Al_2(Mn,Zn,Fe)(SO_4)_4.22H_2O$.	Monoclinic.
Reddingtonite.	$(Cr,Al)_2(Fe,Mg,Ni)(SO_4)_4.21H_2O$.	(?)
Ferronatrite.	$FeNa_3(SO_4)_3.3H_2O$.	Hexagonal; rhombohedral.
Römerite.	$Fe_2(Fe,Zn)(SO_4)_4.12H_2O$.	Triclinic.
Phillipite.	$Fe_2Cu(SO_4)_4.12H_2O$.	(?)
Sonomaite.	$Al_2Mg_3(SO_4)_6.33H_2O$.	(?)
Dumreicherite.	$Al_2Mg_4(SO_4)_7.36H_2O$.	Monoclinic (?).
Aromite.	$Al_2Mg_6(SO_4)_9.54H_2O$.	(?)

Group 15.

Alunite.	$K(AlO)_3(SO_4)_2.3H_2O$.	Hexagonal; rhombohedral.
Ignatievite.		
Jarosite.	$K(FeO)_3(SO_4)_2.3H_2O$.	Hexagonal; rhombohedral.
Moronolite.		

Group 15—Continued.

Löwigite.	$K(AlO)_3(SO_4)_2.4\frac{1}{2}H_2O$.	(?)
Sideronatrite.	$Na_4Fe(FeO)(SO_4)_4.7H_2O$.	Orthorhombic.
Urusite.		
Quetenite.	$MgFe(FeO)(SO_4)_4.13H_2O$.	Monoclinic (?).
Botryogen.	$MgFe_2(FeO)(SO_4)_4.18H_2O$.	Monoclinic.
Klinophaeite.	$(K,Na)_8Al_2(FeO)_3(SO_4)_5.8H_2O$.	Monoclinic (?).
Klinocrocite.		
Plagiocitrite.	$(K,Na)_2Fe[(Fe,Al)O]_6(SO_4)_6.27H_2O$.	Monoclinic.
Voltaite.	$(Mg,Fe)_3(Fe,Al)_4(OH)_2(SO_4)_{10}.14H_2O$.	Isometric.
Metavoltine.	$(K_2,Na_2,Fe)_5Fe_6(OH)_4(SO_4)_{12}.16H_2O$.	Hexagonal.
Ettringite.	$Ca_6Al_2(OH)_{12}(SO_4)_3.24H_2O$.	Hexagonal.

Group 16.

Cyanotrichite.	$Al_2Cu_6S_2O_{15}.12H_2O$.	Orthorhombic.
Zinkaluminite.	$Al_6Zn_6S_2O_{21}.18H_2O$.	Hexagonal.
Woodwardite.	$Al_6Cu_8S_3O_{12}.21H_2O$.	(?)
Knoxvillite.	$(Fe,Ni,Mg)(Cr,Al,Fe)S_3O_{32}.32H_2O$.	Orthorhombic (?).

Group 17.

Johannite.	$Cu(OH)(UO_2)_4SO_4$.	Monoclinic.
Uranopilite.	$Ca(UO_3)_2(SO_4)_2.4H_2O$.	(?)
Uranochalcite.	$Ca(CuO)_4(UO_3)_8(SO_4)_{12}.8H_2O$.	(?)
Voglianite.	$Cu(OH)(UO_3)_9(SO_4)_5.10H_2O$.	(?)
Zippeite.	$Cu(OH)(U_3O_8)(SO_4).12H_2O$.	(?)

SULPHATES WITH CHLORIDES AND CARBONATES.

Group 1.

Sulphohalite.	$3Na_2SO_4.2NaCl$.	Isometric.
Chlorothionite	$CuSO_4.2KCl$.	(?)

Group 2.

Caracolite.	$Na_2SO_4.Pb(OH)Cl$.	Orthorhombic.

Group 3.

Kainite.	$MgSO_4.KCl.3H_2O$.	Monoclinic.

Group 4.

Spangolite.	$Cu_6AlClSO_{10}.9H_2O$.	Hexagonal; rhombohedral.
Connellite.	$Cu_{15}(Cl,OH)_4SO_{16}.15H_2O$.	Hexagonal.

Group 5.

Hanksite.	$9Na_2SO_4.2Na_2CO_3.KCl$.	Hexagonal.

Group 6.

Caledonite.	$(Pb,Cu)_2(CO_3)(SO_4)$.	Orthorhombic.
Leadhillite.	$Pb_4(OH)_2(CO_3)_2SO_4$.	Monoclinic.

TELLURATES AND SELENATES.

Group 1.

Ferrotellurite.	Tellurate of iron.	(?)
Magnolite.	Tellurate of mercury.	(?)

Group 2.

Montanite.	$Bi_2(OH)_4TeO_4$.	(?)

OXYGEN SALTS: CLASS,—CHROMATES.

The chromates, derivatives of H_2CrO_4, or compounds of chromium trioxide with other oxides, have but few representatives among minerals. They are isomorphous with the corresponding sulphates, and, like them, may be either normal or basic salts; further, they may crystallize with carbonates and phosphates.

Group 1.

Tarapacaite.	K_2CrO_4.	Orthorhombic(?).
Crocoite.	$PbCrO_4$.	Monoclinic.

Group 2.

Phœnicochroite.	$Pb(Pb_2O)(CrO_4)_2$.	Orthorhombic(?).
Jossaite.	$(Pb,Zn)(Pb_2O)(CrO_4)_2$.	Orthorhombic.
Vauquelinite.	$(Pb,Cu)(Pb_2O)(CrO_4)_2$.	(?)
Laxmannite.	$Pb(Pb_2O)(CrO_4)_2.(Pb,Cu)_3(PO_4)_2$.	Monoclinic.

Group 3.

Beresovite.	$Pb_2(Pb_2O)_2(CO_3)(CrO_4)_3$.	(?)

OXYGEN SALTS: CLASS,—MOLYBDATES AND TUNGSTATES.

The molybdates and tungstates are derivatives of H_2MoO_4 and H_2WO_4, or compounds of oxides with oxides whose negative parts are taken by molybdenum and tungsten trioxides, respectively. Among minerals normal salts only are known.

Group 1.

Powellite.	$CaMoO_4$.	Tetragonal.
Belonesite.	$MgMoO_4$.	Tetragonal.
Wulfenite.	$PbMoO_4$.	Tetragonal.
Pateræite.	$CoMoO_4$.(?)	Tetragonal.

Group 2.

α. Monoclinic section.

Hübnerite.	$MnWO_4$.
Wolframite.	$(Mn,Fe)WO_4$.
Ferberite.	$FeWO_4$.
Raspite.	$PbWO_4$.

β. Tetragonal section.

Scheelite.	$CaWO_4$.
Cuproscheelite.	$(Ca,Cu)WO_4$.
Reinite.	$FeWO_4$.
Stolzite.	$PbWO_4$.

OXYGEN SALTS: CLASS,—IODATES.

There are but two members of this class, derivatives of $I(OH)_7$, at present known among minerals. One is a normal salt, the other a double salt.

Group 1.

Lautarite.	$Ca(IO_3)_2$.	Monoclinic.

Group 2.

Dietzeite.	$7Ca(IO_3)_2.8CaCrO_4$.	Monoclinic.

OXYGEN SALTS: CLASS,—URANATES.

The uranates, derivatives of $U(OH)_6$, or compounds of the oxides of uranium with other oxides, are very complex in composition. They contain, in addition to the oxides of uranium, the oxides of thorium, zirconium, yttrium, and the cerium metals. Certain of the uranates also contain nitrogen and helium in an unknown state of combination.

Group 1.

Uraninite.	Contains UO_2, UO_3, PbO, N, He, and A.	Isometric.
Bröggerite.		
Cleveite.		
Nivenite.		

Group 2.

Uranosphærite.	$(BiO)_2U_2O_7.3H_2O$.	(?)

D. COMPOUNDS OF ORGANIC ORIGIN.

This division may be separated into two general groups—salts of oxalic and mellic acids and other carbon compounds. This last comprises the various kinds of mineral wax, the fossil resins, the asphaltums, mineral oils, coals, etc. They are in general simply mixtures. The salts of the organic acids, oxalates, and mellates only are here given.

SALTS OF ORGANIC ACIDS.

Group 1. Oxalates.

Whewellite.	$CaC_2O_4.H_2O$.	Monoclinic.
Oxammite.	$(NH_4)_2C_2O_4.2H_2O$.	Orthorhombic.
Humboldtine.	$2FeC_2O_4.3H_2O$.	(?)

Group 2. Mellates.

Mellite.	$AlC_{12}O_{12}.18H_2O$.	Tetragonal.

INDEX TO MINERALS.

A.

L.

M.

ARROWPOINTS, SPEARHEADS, AND KNIVES OF PREHISTORIC TIMES.

BY

THOMAS WILSON, LL. D.,
Curator, Division of Prehistoric Archæology, U. S. National Museum.

TABLE OF CONTENTS.

LIST OF ILLUSTRATIONS.

PLATES.

TEXT FIGURES.

ARROWPOINTS, SPEARHEADS, AND KNIVES OF PREHISTORIC TIMES.

By Thomas Wilson, LL. D.,
Curator, Division of Prehistoric Archæology.

INTRODUCTION.

A spear is a long, pointed weapon, held in the hand, used in war and hunting, more by thrusting than throwing. Lance is synonymous with spear, though it may be smaller and lighter, but longer, used either by thrusting or throwing. A javelin is shorter, smaller, and lighter than the spear or lance and is better adapted to throwing by the hand. All of them may, in case of need, be used in hand-to-hand combats or in an assaulting column.

A harpoon is a spear or javelin with barbs or toggles, usually thrown at fish or marine animals, though specialized for striking whales.

An arrow is similar to a javelin, but shorter, smaller, lighter, and to be shot from a bow. It is a missile and purely offensive. In prehistoric times and before metals were in use these were tipped with stone or bone.

The arrowpoints, spearheads, and knives of the prehistoric races, when made of stone, have such a likeness of form and style that a sharp line of division between them is impracticable. A small implement may be an arrowhead; a large one of the same type may be a spearhead, while either or both may have served as knives. The distinction might be better made if the shafts or handles remained, but these, together with the lashings and attachments, have decayed and disappeared, except occasionally where bitumen or gum was employed. An implement of this kind, whether large or small, with a light shaft 2 or 3 feet long would be an arrow; the same with a heavy shaft 8 or 10 feet long would be a spear, while either of them with a shaft a foot or less in length would be a knife, dagger, or poniard. Indeed, an implement of the latter class might be accidentally made through the breaking of a spear or arrow shaft. Few if any of these implements of the real prehistoric man have been found with their shafts or handles and lashings or fastenings, and so we are largely driven to theory and analogy for their names and uses. In modern times the perfect arrow, first with a stone head, afterwards with one of iron, and shaft attached, was used in great numbers by the North American Indians; spears complete, with stone or iron head and shaft attached, were used by the Eskimos, and knives with short handles have been found among the Hupa Indians of Oregon and California, and a few in prehistoric graves on the

Mexican border. In Africa, Australia, and Polynesia, the spears and knivesare usually of iron, socketed or tanged for the insertion of a handle.

This paper deals principally with the prehistoric arrowpoint and spearhead, beginning with the ruder forms of cutting, piercing, or throwing weapons or implements in the Paleolithic period, and dealing with the subject in all its characteristics. Bows are practically unnoticed, as most specimens from prehistoric times have decayed, but one or two having been found, and these only preserved by being under water or in peat beds.

I. SPEARS AND HARPOONS IN THE PALEOLITHIC PERIOD.

Appearance of the spear in the Mousterien epoch—Appearance of the harpoon in the Solutréen epoch—Spear or harpoon heads with shoulder on one side only.

The spear belongs to an earlier epoch in man's civilization than does the arrow. Although they are similar in appearance, they differ greatly in age. The former appeared in the Paleolithic period, while the latter did not appear until the Neolithic.

Fig. 1.

ACHEULÉEN IMPLEMENT OF FLINT.

Side view.

St. Acheul, France.

½ natural size.

Fig. 2.

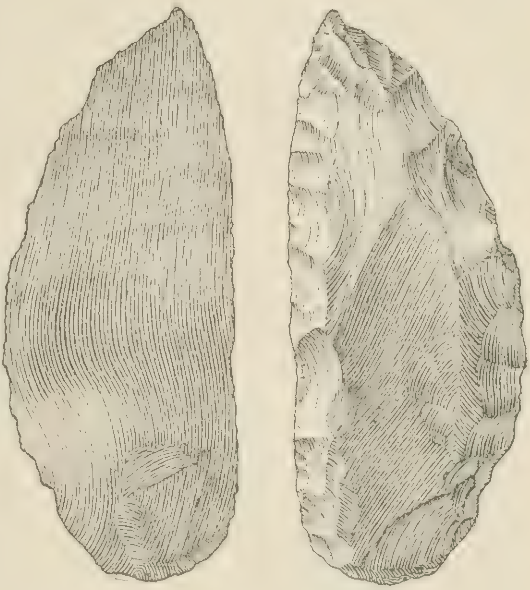
PALEOLITHIC IMPLEMENT OF QUARTZITE.

Madras, India.

Cat. No. 137535, U.S.N.M. ½ natural size.

The first implements known to have been used by man were the rude, thick, heavy, chipped flints which belong to the Chelléen epoch of the

Paleolithic period. They were probably never used with a handle, for it is hard to conceive an implement so ill contrived for attachment to a handle. They are nearly the shape of an almond or peach stone (figs. 1, 2). A portion of the natural crust of the flint pebbles was left at the butt of some of these implements for a grip, thus showing that they were intended to be held in the hand, and not to be handled for use as spears or javelins. These implements are not thin and flat so as to be inserted in a split handle, and whether attempted longitudinally as for a spear, or transversely as for an axe, it would be with difficulty that any of them could either then or now be retained in a handle. If inserted in a wooden handle a sufficient distance to hold, a blow given with force would drive it into and through the wood, and would certainly split the handle. Being insufficiently inserted, it would fly out.



Figs. 3, 4.

MOUSTERIEN SPEARHEAD OF FLINT.

Obverse and reverse.

Le Moustier, France.

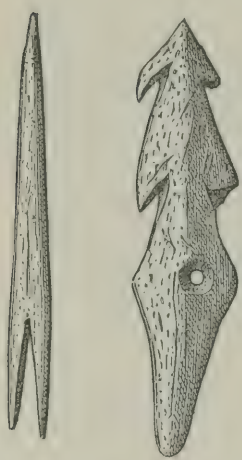
Cat. No. 9015, U.S.N.M. Natural size.

We are not driven to theory entirely with regard to this matter, for aside from the fact that some of these are left with the butt of the flint pebble for a grip, the inventive genius of man has not yet been able to discover and employ a handle that could be attached to these or similar implements without being open to one of these objections. Attempts have been made in this direction by several persons, notably in a series in Carnavalet Museum, the municipal museum of Paris. An inspection of this series or of any of the implements themselves will show the impracticability of handling them.

It does not necessarily follow, because these Chelleen implements were not put in a handle and used as spears, that, therefore, the man of that period had no spear, for a sapling or branch of a tree, sharpened and hardened by fire, would have made a most effective weapon of the spear or javelin sort. It may be objected that no such objects have ever been found, yet this is not conclusive against the possibility of the wooden implement having been made, for, being wood, it might have decayed long before the historic period.

In the middle part of the Paleolithic period an implement appeared which we may well suppose to have been the head of a spear or javelin (figs. 3, 4).

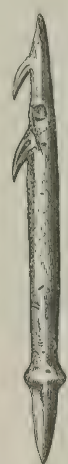
These implements have been called Mousterien points from their having been found in purity and profusion in the cavern of Moustier on the river Vézère in France. Their character is shown by the two figures, being the opposite sides of the same implement, obverse and reverse. They are smooth flakes of flint, thin, rather heavy at the butt, tapering on sides and edges to a point. They were struck from a core of flint at a single blow, which left a broad, flat surface on the inside, showing the conchoid of percussion. The workmen in manufacturing the implement left this side in its original condition as it came from the block. The outer side



Figs. 5, 6.

PALEOLITHIC POINTS AND HARPOONS OF REINDEER HORN.

La Madeleine, France.



Figs. 7-10.

PALEOLITHIC POINTS AND HARPOONS OF REINDEER HORN.

La Madeleine, Dordogne, France.

Lartet and Christy. $\frac{2}{3}$ natural size.

was chipped by small flakes to a regular outline and made sharp along the two edges and at the point. None of the objections made to the handling of the Chelléen implement apply to this. It was and is easy to insert this implement into a cleft stick and fasten it tightly either with thongs or bitumen so as to be effective as a spear or javelin. There is no positive evidence that they were thus used, but the fact that it could have been done, that similar implements were and are thus

used among savages, and that those belonging to the preceding epoch could not have been thus used, establishes a fair presumption in that behalf. This fact being admitted, these represent the earliest spearheads made by man. If these implements were rare, the argument would be correspondingly feeble, but they have been found in great numbers over a large portion of western Europe, and the epoch to which they belonged is believed by M. de Mortillet to have been of greater duration than any other in the Paleolithic period.

In the continuation of the Cavern period to what M. de Mortillet calls the Solutréen epoch, where the inventive genius and the mechanical ability of man became higher, implements are found which establish beyond dispute their use as spears or javelins. True, they have been used as harpoons, but what is a harpoon but a barbed spear or lance? Many of them were of bone or horn. Figs. 5, 6, 7, 8, and 9 are here introduced as typical representations of thousands which have been found in southern France, belonging to this epoch of the Paleolithic period. Those here shown are of reindeer horn and are about natural size. Observe the straight, smooth, tapering points. In one of them (fig. 5) the base is bifurcated to receive the end of a shaft; another has the base brought to a point for insertion into the shaft, and, after the fashion of the Eskimo and other fisher people, it has a hole apparently for the attachment to its shaft by string (fig. 6). The others, larger ones, have at their base an enlargement or swelling, over which the hollow shaft can be forced for a given distance, which, lashed tightly with a thong, will keep it firm, or, inserted but slightly, will allow it to pull out and remain in a wound while the shaft is released (figs. 7–10).

These objects, having belonged to the Paleolithic period entirely disassociated

Fig. 11.

SOLUTRÉEN POINT OF CHIPPED FLINT.

Solutré, France.

Rigny-sur-Arroux (Saone-et-Loire). $\frac{2}{3}$ natural size.

with objects of the Neolithic period, constitute satisfactory evidence that man of the Paleolithic period made and used harpoons, and consequently must have been able to make spears and javelins. The difference between the two is more in name than aught else. They are both used in the same way, both serve the same purpose, and with the variation of material and barbs are essentially the same weapon.

These bone and horn harpoons serve to elucidate similar implements of the same period made of flint and to identify them as spears or javelins and not arrows.

Fig. 13.

Fig. 14.

Fig. 12.

SOLUTRÉEN POINTS OF CHIPPED FLINT.

France.

Cast, Cat. No. 99747, U.S.N.M. ⅔ natural size

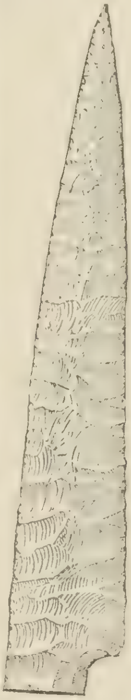
Figs. 11, 12, 13, and 14 show a number of the well-known leaf-shaped implements, called in France *feuille de laurier*, or laurel leaf, from their resemblance to it in shape. This period represents as high a degree of mechanical skill in flint chipping as any other in the world's history.

An examination of these implements is required to understand the delicacy of their manufacture. It required much experience to obtain the needed amount of manual dexterity. One of these leaf-shaped implements, found *en cache* with ten others, is shown in fig. 11. It is one of the largest, being 14 inches long, $3\frac{1}{4}$ inches broad, and its greatest thickness is less than three-eighths of an inch. The original is in the museum of Chalon-sur-Saône. The implement is made entirely by chipping, the finishing on the edge of which would appear to have been done by pressure and not by strokes. No flint-knapper of the present day, whether amateur or professional, has yet been able to reproduce one of these fine Solutréen leaf-shaped implements. The U. S. National Museum has had many times to contend with fraudulent and spurious specimens which showed considerable manual dexterity, but it has never been presented with counterfeits of these beautiful implements.

They were perfectly adapted for insertion in a handle and could then be used with effect as spears or javelins, according to their size and weight. They might have been taken in the hand and used as knives, the hand being protected by a bit of the skin of an animal or a bunch of grass. They were of all sizes (the figures are two-thirds natural size) and came down from the large one just mentioned, through gradations, to those not more than three-fourths of an inch long and one-half an inch wide. Figs. 15 to 18 show implements of the same

epoch, the shoulder being on one side, contrary to the arrow and spear heads of the Neolithic period, and bearing a great similarity to its brother, the harpoon.

These and similar implements, made of bone and horn, were continued in use throughout the Paleolithic period. So it is proved by deduction and induction that the bow and arrow did not make its appearance during the Paleolithic period, but are later than either the spear or javelin.



Figs. 17, 18.

SOLUTRÉEN FLINT POINTS.

Shouldered on one edge.

Dordogne, France.

Natural size.

Figs. 15, 16.

SOLUTRÉEN POINTS OF CHIPPED FLINT.

Shouldered on one edge. One finished, one unfinished.

Dordogne, France.

The author does not forget the differences of opinion between M. de Mortillet and M. d'Acy as to the various types of Paleolithic implements, and the extinct fauna associated therewith, found in the alluvial gravels of northern France and southern England. He knows also the subdivision called St. Acheuleén, proposed by M. d'Ault Dumesnil, and he does not enter into any of these discussions. His position in this paper does not conflict with either. Whether the Mousterien point was contemporaneous with the Chelléen implement, or was subsequent to it, or how many changes or epochs are represented by the two styles of implements, does not affect the statement that the Chelléen implement probably was not, and the Mousterien probably was, used as a spearhead, and that despite the stemmed and barbed harpoons of the Solutréen or Cavern period, there is no evidence that the bow and arrow was known or used during the Paleolithic period. In this position the author is sustained by one of the highest authorities on the subject in the United States, Prof. Henry W. Haynes, of

Boston, who, as long ago as February 3, 1886, published a paper, the title of which indicates his opinion: The Bow and Arrow Unknown to Paleolithic Man.[1]

II. THE ORIGIN, INVENTION, AND EVOLUTION OF THE BOW AND ARROW.

Origin unknown—A wonderful contrivance—Its mythology—Its history—Arrow release in antiquity.

Of the origin of the bow and arrow, history is silent. We know nothing whatever of its origin from any written word or description in any language or of any people. It is entirely prehistoric. Our only knowledge of its beginning comes from such of the remains of human industry belonging to prehistoric times as have been found in modern times. We can easily base our conclusions on comparisons of these remains. We have seen how the spear and harpoon and possibly the javelin belonged to the Paleolithic period or chipped-stone age; and now we will see how the bow and arrow was an invention of the Neolithic period or polished-stone age. But both these ages lie far back in the past, earlier than any written history, and were unknown to the world until the discoveries of the nineteenth century.

A stick or staff sharpened or hardened by fire might make a spear. Herodotus[2] says, describing the army of Xerxes, that "the Libyans marched clad in leather garments and made use of javelins hardened by fire" (pp. 836, 847). To tip the staff with a bit of flint would be but the first step in the evolution of a better weapon, which, once taken, might continue through all its varieties, from the heaviest and longest spear to the shortest and lightest javelin—from one which was too heavy to carry and was simply to be held up after the fashion of an abattis protecting the holder against an onslaught, down to a lighter and smaller implement which he could hurl at his enemy. All this is in the natural evolution of an invention. One might grow out of the other. We have no positive knowledge that this was the manner of growth, but we may easily surmise it, if not with the Libyans, then with some other and possibly more primitive people.

Hence we can see how the commonly accepted law of evolution and progress may be set at naught by observed facts. The Libyans were noted soldiers and formed part of the greatest army of earth, and one would suppose a priori that their arms would have been of the most approved pattern, but their javelins were the most primitive and rude type, the beginning—really the first step—in warfare; the protoplasm of weapons: the staff sharpened and hardened by fire. So much for spear and javelin.

The bow and arrow is a different weapon, and its invention had no

[1] Proceedings of the Boston Society of Natural History, XXIII, p. 269.

[2] Book VII, 71.

relation with the spear, lance, or javelin. It is a machine, requiring the combined action of two objects. It was the first projectile weapon known to or used by man. The world has accepted the existence of the bow and arrow without much thought of its origin. It belonged to primitive man, and we received it as though part of him. But a moment's consideration of the condition of a savage who had never seen or heard of any machine by which missiles could be thrown farther or harder than he could do it with his hand—that this savage should have invented the spring of the bow, should have utilized it by tightening the cord, and arranged the whole so that by drawing the cord and its sudden release, could project an arrow with such force as to be an effective weapon—that he could do this is a matter of wonder. This invention of the savage is one of the triumphs of mind. It is an illustration of the inventive genius and intellectuality of man. There is but little doubt that it marked an epoch in that dead and gone civilization equal to the discovery in the later years of its complement and successor, gunpowder, and it may have wrought as great a change in man's condition on earth.

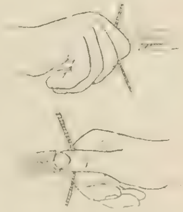


Fig. 19.
PRIMARY ARROW RELEASE.
Prof. E. S. Morse, Bulletin Essex Institute, 1885, XVII, p. 148.

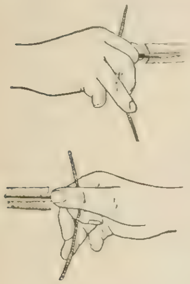


Fig. 20.
SECONDARY ARROW RELEASE.
Prof. E. S. Morse.

In whatever quarter of the globe or among whatever people the bow and arrow has been found, it antedates all our knowledge of it or them as obtained through history. The earliest writers of antiquity mention the bow and arrow as an implement of warfare or the chase as though it was then an old and well-known weapon. Homer, Herodotus, Tacitus, Strabo, and Pliny all mention it. The many references to it in the earlier books of the Bible show it to have been at that time a weapon in common use.

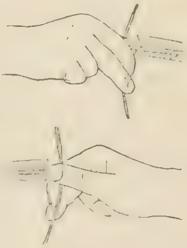


Fig. 21.
TERTIARY ARROW RELEASE.
Prof. E. S. Morse.

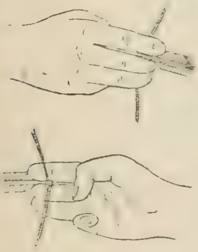


Fig. 22.
MEDITERRANEAN ARROW RELEASE.
Prof. E. S. Morse.

Prof. E. S. Morse, in his study of the different modes of arrow release,[1] (figs. 19, 20, 21, 22, and 23) shows the existence of the bow and arrow in early Egyptian, Assyrian, Etruscan, and Grecian times, from the ancient sculptures and bas-reliefs, although it is only incidental to his subject. If its existence or origin had been in question his illustrations could have been multiplied numberless times from the ancient sculptures, bas-reliefs, painted vases, and coins of antiquity.

[1] Bulletin, Essex Institute, XVII, October to December, 1885, pp. 145–198.

Whether these arrowheads were of stone or metal can not be known from the representations; but the earliest mentioned by historians are of metal.

The bow is represented on the most ancient monuments. In classic art it is an attribute of Apollo, Cupid, Diana, Hercules, and the Centaurs. The form represented was that of the Greek bow—two arcs united by a straight piece in the middle. Grecian mythology attributes the invention of the bow to Scythes, the son of Hercules, or to Perse, the son of Perseus, but Herodotus supposes this to be a tradition of the skill in archery of the Scythians and Persians.

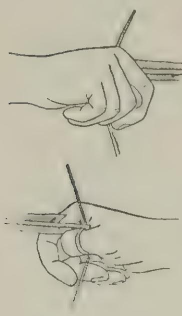


Fig. 23.
MONGOLIAN ARROW RELEASE.
Prof. E. S. Morse.

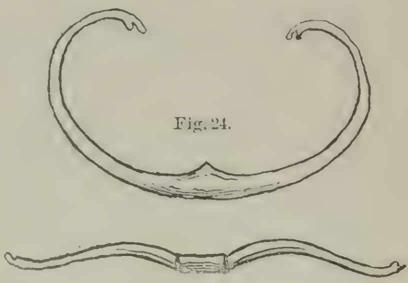


Fig. 24.

Fig. 25.
(Fig. 24) SCYTHIAN AND PARTHIAN BOW.
(Fig. 25) GREEK BOW.
Smith's Dictionary of Greek and Roman Antiquities title Arcus.

Smith, in his Dictionary of Greek and Roman Antiquities, under the title "Demosii," says:

> Another class of public slaves formed the city guard of Athens, * * * they were generally called bowmen * * * or, from the native country of the majority, Scythians.

And again, under the title "Arcus:" "The form of the Scythian and Parthian bow differed from that of the Greeks," and he figures the two (figs. 24, 25).

He continues, saying that Homer has described the Greek bow[1] as made of two pieces of horn, and the bowstring of thongs of leather twisted, but Pandarus's bow was strung with sinew. The bowstring was fastened at one end of the bow, and at the other there hung a hook or ring of metal into which the string was caught when the bow was to be used; when not in use, the bow was unstrung and put in a case of leather, ornamented[2] as shown in fig. 26.

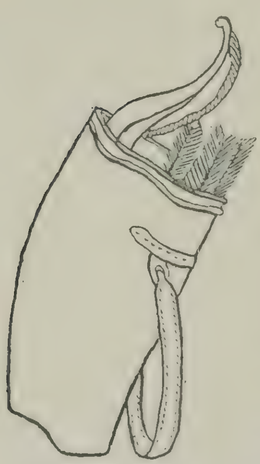


Fig. 26.
GREEK BOW CASE AND QUIVER.
Smith's Dictionary of Greek and Roman Antiquities.

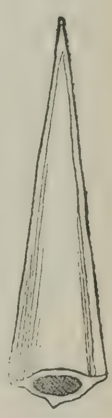


Fig. 27.
GREEK BRONZE "THREE-TONGUED" ARROW-POINT.
Persepolis.

[1] Iliad, Book IV, 105–126.

[2] Odyssey, Book XXI, 54.

The arrowheads were of bronze, Homer says "three-tongued," as shown in fig. 27, and those from Marathon shown further on (fig. 28). The arrow shafts were of light wood or smooth cane, well polished.

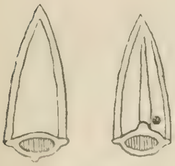


Fig. 28.

GREEK BRONZE "THREE-TONGUED" ARROW-POINTS.

Marathon.

Smith's Dictionary title. Sagitta.

In the Trojan war the spear, lance, or javelin was the principal weapon and used in all three capacities, according to the need. It could naturally be thrown but a short distance in the immediate presence of the enemy, and was sometimes used in hand to hand conflicts.

Homer describes in detail the arms and armor of the Greeks and Trojans and their various uses, and makes apparently no distinction between those of the two peoples.

Achilles, in the combat with Hector:

* * * and, poising, hurled his weighty spear,
But Hector saw and shunned the blow; he stooped,
And o'er his shoulder flew the brass-tipped spear,
And in the ground was fixed: but Pallas drew
The weapon forth, and to Achilles' hand,
All unobserved of Hector, gave it back.

Then Hector:

Poising, hurled his ponderous spear,
Nor missed his aim; full in the midst he struck
Pelides' shield; but, glancing from the shield,
The weapon glided off. Hector was grieved
That thus his spear had bootless left his hand.
He stood aghast; no second spear was nigh:
And loudly on Deiphobus he called
A spear to bring; but he was far away.

Again Hector:

Thus as he spoke, his sharp-edged sword he drew,
Ponderous and vast, suspended at his side;
Collected for the spring and forward dashed. * * *
Achilles' wrath was roused: with fury wild
His soul was filled: before his breast he bore
His well-wrought shield; and fiercely on his brow
Nodded the four-plumed helm, * * *
Gleamed the sharp-pointed lance, which in his right
Achilles poised, on god-like Hector's doom
Intent, and scanning eagerly to see
Where from attack his body least was fenced.
All else the glittering armour guarded well, * * *
One chink appeared, just where the collar bone
The neck and shoulder parts, beside the throat, * * *
There levelled he. [Iliad, XXII, 320.

In the combat with Ajax, Hector:

Poising, hurled his ponderous spear;
The brazen covering of the shield it struck,
The outward fold, the eighth, above the seven

Of tough bull's hide; through six it drove its way
With stubborn force, but in the seventh was stayed.
Then Ajax hurled in turn his ponderous spear,
And struck the circle true of Hector's shield:
Right through the glittering shield the stout spear passed,
And through the well-wrought breastplate drove its way,
And underneath, the linen vest it tore;
But Hector, stooping, shunned the stroke of death.
Withdrawing then their weapons, each on each
They fell. * * *
Then Hector fairly in the center struck
The stubborn shield; yet drove not through the spear;
For the stout brass the blunted point repelled.
But Ajax, with a forward bound, the shield
Of Hector pierced; right through the weapon passed. [Iliad, VII, 273.

The spear shaft was made of ash, and was tough and strong, thus:

The son of Peleus threw
His straight-directed spear; his mark he missed,
But struck the lofty bank, where, deep infixed
To half its length, the Pelian ash remained.
Then from beside his thigh Achilles drew
His trenchant blade, and, furious, onward rushed;
While from the cliff Asteropæus strove
In vain, with stalwart hand, to wrench the spear.
Three times he shook it with impetuous force,
Three times relaxed his grasp; a fourth attempt
He made to bend and break the sturdy shaft. [Iliad, XXI, 192.

Their spears lost or broken, they resorted to their swords:

Then Peneleus and Lycon, hand to hand,
Engaged in combat: both had missed their aim,
And bootless hurled their weapons: then with swords
They met. First Lycon on the crested helm
Dealt a fierce blow; but in his hand the blade
Up to the hilt was shivered. Then the sword
Of Peneleus * * *
* * * deeply in his throat the blade
Was plunged. [Iliad, XVI, 385.

One of the tactical maneuvers of the Greek soldier was to thrust the lance into and through the shield of his opponent, and while he was disengaging it to attack him with the sword.

The swords, shields, and armor are described by Homer, and, as already seen, most of the combats were hand to hand. It is curious to consider that until the invention of the sling and the bow and arrow there was no projectile weapon used in warfare except the lance or javelin. The knights of ancient times, as well as medæval, fought in armor, and whether on foot, on horse, or in a chariot, they pressed the fight hand to hand. It seems curious in these days of long-range guns to think of great wars carried on as prize fighters would, and that beyond arms' length meant out of danger.

Archers could not carry shields, and so were driven to ask protection

of some spear—or swordsman, and this may have had such implication of cowardice or degradation as to account for the rarity of the use of the bow and arrow, for it seems certain that while it was used in the Trojan war it performed but a subordinate part. Paris was an expert archer; Teucer had a bow; Meriones discharges an arrow which strikes Menelaus. "Pandarus the god-like, Lycao's son," was the skilled archer from Crete. His bow, arrow, and quiver are described, and how he was called to act the part of the sharpshooter. Diomedes was dealing destruction among the Greeks when Æneas sought Pandarus—

* * * and addressed him thus:
"Where, Pandarus, are now thy wingéd shafts,
Thy bow, and well-known skill, wherein with thee
Can no man here contend? Nor Lycia boasts
Through all her wide-spread plains a truer aim.
Then raise to Jove thy hands, and with thy shaft
Strike down this chief, whoe'er he be, that thus
Is making fearful havoc in our host!" [Iliad, V, 196.

The bow of Pandarus, with its accompaniments, and the operation of shooting Diomedes, are thus described:

Straight he uncased his polished bow, his spoil
Won from a mountain ibex, which himself,
In ambush lurking, through the breast had shot,
True to his aim, as from behind a crag
He came in sight; prone on the rock he fell,
With horns of sixteen palms his head was crowned.
These deftly wrought a skilful workman's hand,
And polished smooth, and tipped the ends with gold.
He bent, and resting on the ground his bow,
Strung it anew. * * *
His quiver then withdrawing from its case,
With care a shaft he chose, ne'er shot before,
Well-feathered, messenger of pangs and death,
The stinging arrow fitted to the string. * * *
At once the sinew to the notch he drew;
The sinew to his breast and to the bow
The iron head; then when the mighty bow
Was to a circle strained, sharp rang the horn,
And loud the sinew twanged as toward the crowd
With deadly speed the eager arrow sprang—it struck
Just where the golden clasps the belt restrained,
And where the breast-plate, doubled, checked its force.
On the close-fitting belt of curious workmanship
It drove, and through the breastplate richly wrought
And through the coat of mail he wore beneath,
His inmost guard, and best defence to check
The hostile weapon's force; yet onward still
The arrow drove. [Iliad,[1] V. 119.

At the extremity of the plain of Marathon, Greece, is the tumulus mentioned by Pausanias as having been erected over the Athenians

[1] Earl Derby's translation, London, 1867.

killed in that battle, B. C. 490. It was excavated by François Lenormant, and his report was published.[1] A great number of bronze arrowheads were found, short, barbed, socketed, and with three facets.

Flakes of black flint were also found, which were thought by some to have served as arrowheads, but this has been combated and is doubtful. They were all the same type and did not resemble any known standard of arrowhead. They were but fragments of an irregular triangular form, 1¼ to 1½ inches in size, and curved at the point. M. Lenormant is clearly of the opinion that these were not of Greek origin. The black flint is almost unknown in Greece, and he suggests that they might have been used by some of the Persian archers. But even this is doubtful, for we know that bronze and iron arrowheads were used at that period by the Persians as well as by the Greeks. The latter had used them in the days of Homer (figs. 24, 25).

The knowledge of bronze is believed to have come from the East, and if so, would have been known in Persia even before it became known in Greece. It is doubtful if they were arrowheads at all, but if they really were it is much more likely they belonged to the Persian allies than to the Persians themselves. The Scythians and Parthians, coming from the direction of Persia, were the most celebrated archers of the known world, and had bronze, if not iron, arrowheads. History helps us in the view that these stone arrowheads, if they were such, did not come from Persia, nor from the East, but from Ethiopia—the far South.

Herodotus[2] described the arms of the various peoples forming the army of Xerxes. Most of them had the bow and arrow, but stone points were used only by one people.

> The Persians * * * had short spears, long bows and arrows made of cane * * * and under them their quiver hung. * * * The Indians * * * had bows of cane and arrows of cane tipped with iron. * * * The Bactrians had bows of cane, peculiar to their country. * * * The Parthians, Chorasmians, Sogdians, Gandarians, and Dadicæ had the same as the Bactrians. The Caspians, Savangæ, and Pactyes had bows of cane. * * * The Arabians carried at their right sides long bows which bent backward. The Ethiopians carried long bows, not less than four cubits, made from branches of the palm tree, and on them they placed short arrows made of cane; instead of iron, tipped with stone, which was made sharp and of that sort on which they engrave seals. * * * They had javelins tipped with antelope's horn made sharp like a lance.

The Scythians and the rude tribe of Massagetæ used bronze arrowheads in the time of Herodotus, who records[3] how that one Ariantas, a king of the Scythians, took the census of his people by requiring each one to contribute an arrowhead, the whole of which he put in the melting pot and cast into an enormous bronze vessel.[4]

Our modern discoveries point toward bronze and iron having come from the Orient, and getting into Egypt and Ethiopia later than into Assyria or Asia Minor.

Armenia and Caucasus, that vast mountainous and comparatively

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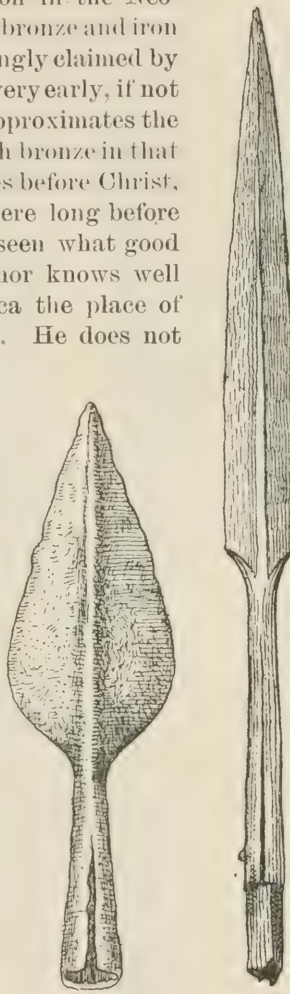
[1] Revue Archæologique, Paris, February, 1867. [2] Book VII, 61–80.
[3] Book IV, 81. [4] Sir John Evans, Ancient Stone Implements, p. 329.

unknown country lying between and to the south of the Black and Caspian Seas, has been lately subjected to critical archaeologic researches.[1]

Metals were there early discovered and put to use. But few localities found by the explorers show occupation in the Neolithic period pure and simple. Knowledge of bronze and iron dates to almost the earliest times. It is strongly claimed by de Morgan that Armenia was the seat of a very early, if not the original, discovery of iron. When he approximates the appearance and use of iron in connection with bronze in that country to a period twenty to thirty centuries before Christ, and shows that iron was in common use there long before it was in the adjoining countries, it will be seen what good ground he has for his assertion. The author knows well that M. de Mortillet has assigned to Africa the place of discovery of iron, and this may be correct. He does not argue the proposition; it is aside from his present purpose. He is endeavoring to show the probability that the Ethiopian flint arrowheads in the army of Xerxes came rather from Africa than Asia, and that in the latter country stone as a material for arrow and spear heads had been superseded by metal—bronze and iron.



FIGS. 29, 30.

PREHISTORIC IRON SPEARHEADS.

Cemetery of Mouçi-yéri, Russian Armenia.

de Morgan, figs. 46, 48.

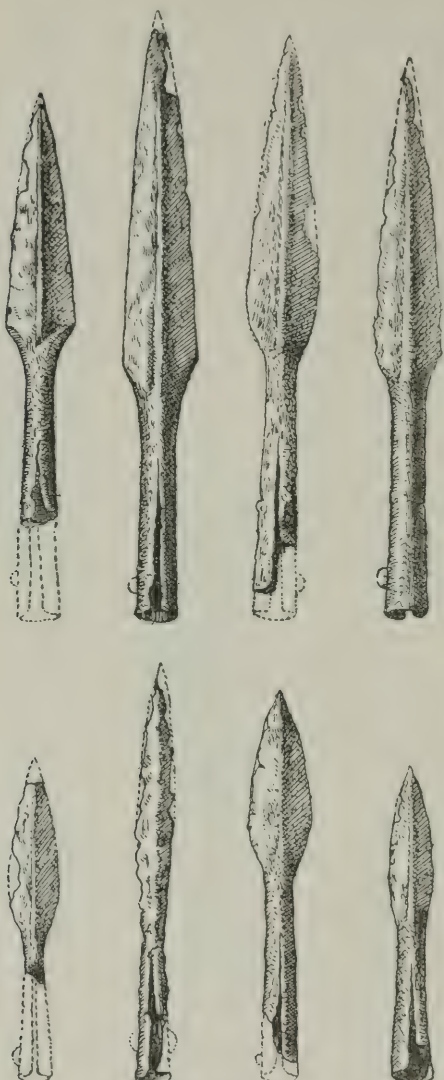
De Morgan[2] describes swords, poniards, lances, hatchets, bows, and arrows. He says that there were found in the cemetery of Redkine lance heads of both bronze and iron, in the cemetery of Lelwar those of iron only. They were practically the same type, the blade long and narrow in the form of a willow leaf. They all had a projecting rib running longitudinally through the center to strengthen it. They were furnished with a socket in which the shaft was inserted and one or two holes for nails to fasten it. Of course the handle was decayed and lost, but in a few cases remains were found stuck in the socket which enabled them to suppose it had been of ash.

These iron lance heads varied greatly in size, form, and fashion. Figs. 29 and 30 are from the cemetery of Mouçi-yéri; fig. 29 is 4 inches long and $2\frac{1}{2}$ inches wide; fig. 30 is 25 inches long. The former blade is

[1] E. Chantre, Recherches Anthropologiques dans le Caucase; J. de Morgan, Premiers âges des Metaux dans l'Arménie Russe, Paris, 1889; J. Mourier, L'Archaeologie au Caucase, Paris, 1887.

[2] Les premiers âges des Métaux dans l'Arménie Russe, pp. 89–101.

long and narrow, while the latter is short and broad. Figs. 31–38 shows eight of these iron lance heads, all from the cemetery of Cheïtan-thagh.



Figs. 31–38,
PREHISTORIC IRON SPEARHEADS.
Cemetery of Cheïtan-thagh, Russian Armenia.
de Morgan, fig. 47. ⅕ natural size.

The variations of these spearheads show them to have been the product of individual design and manufacture, and that they were not made by a machine or after a single pattern. They are all socketed; the socket is not solid, but open on the side, showing they were hammered and not cast. The sockets were not welded nor brazed. Whether they could weld or braze two pieces of iron together must be left uncertain. It may, however, be considered certain that they knew of and employed a heat sufficient to weld, and used it in the manufacture of these implements, for without a welding heat they could not make these sharp edges and points. On one of the Egyptian bas-reliefs (at Medinet Abou, Thebes, twentieth dynasty) a Thyrenien warrior is shown with two spears as though one might have been for throwing as a javelin and the other for hand to hand combat.

There was a series of knives of iron from the cemetery of Cheïtan-thagh, Armenia. The handles had been of wood, bone, or horn, fastened much the same as the butcher or carving knife of modern times. Some had a tang inserted in deer horn, some had pieces of bone, others pieces of wood cut thin and laid on both sides, riveted through. The U. S. National Museum possesses a series of the latter obtained direct from M. de Morgan which is represented in the accompanying photographic plate (Plate 1).

The engraving on the bronze belts or cinctures of the warriors show

PREHISTORIC IRON KNIVES AND SPEARHEADS.

Cemetery of Chei'tan-thagh, Russian Armenia.

J. De Morgan, Mission Scientifique au Caucase, I, (Les Premiers Ages des Metaux dans l'Arménie Russe), p. 132, fig. 121.

the form and use of the bow and arrow in that locality at that period. The bow was longer than a man was tall. It was not regular in its form, as are most bows. It consisted of three curves, the center being the smallest and shortest. The drawings (figs. 39, 40) show the form. These forms may have been exaggerated by the ancient artist, but they are our only source of knowledge. From the scenes depicted elsewhere on the cinctures, it is concluded that these bows served for the chase as well as for war.

Chips and flakes of obsidian, few in number and irregular and uncertain in form and from the mountains of Allagheuz, were found by de Morgan, which he thinks may have been used as arrowheads. The author may be permitted to doubt the generality of such usage—he would not deny isolated or sporadic cases.

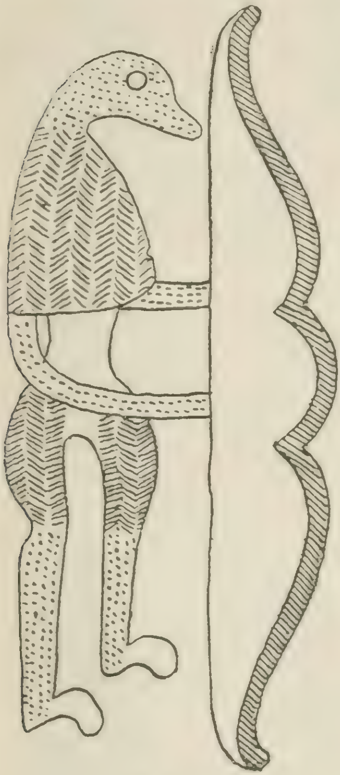


Fig. 39.

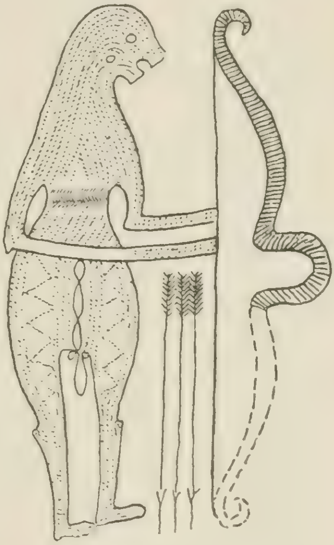


Fig. 40.

PREHISTORIC ARMENIAN BOWS, ENGRAVED ON BRONZE CINCTURES.

Fig. 39—From cemetery of Akthala; fig. 40—from Mouçi-yéri.

de Morgan, figs. 54, 191. Natural size.

The arrowheads found were of bronze or iron (figs. 41–45,) and were of curious forms, some socketed, some stemmed, some with long, fine barbs, others leaf-shaped. Some were arranged with a stem or tang to be inserted in the shaft (figs. 42, 43), others had a socket in which the arrow shaft was to be inserted, and a small hole was provided with a nail or point to fasten it (figs. 41, 44, 45). Some had a curious barb, more the appearance of a nail or spur, springing from the socket, which had

been bent backward into the form of a hook, thus making it into a barb (fig. 41). Some were arranged with barbs, others without. The bronze implements were cast, the iron ones hammered.

A few of the implements of chisel shape, if arrowheads, of the form tranchant transversal, were found in the cemetery of Mouçi-yéri (figs. 46, 47). It is curious to remark that while the bronze and iron arrowheads of this period and locality are the general form of chipped-stone arrowheads of prehistoric times, those of chipped stone—that is, the obsidian specimens—are of a new and almost unknown form, ruder and more archaic than found elsewhere.

The warrior or hunter carried all or several kinds of arrows. Their quivers when found contained an assortment. Those of bronze were in the greatest number, then iron, and lastly stone.

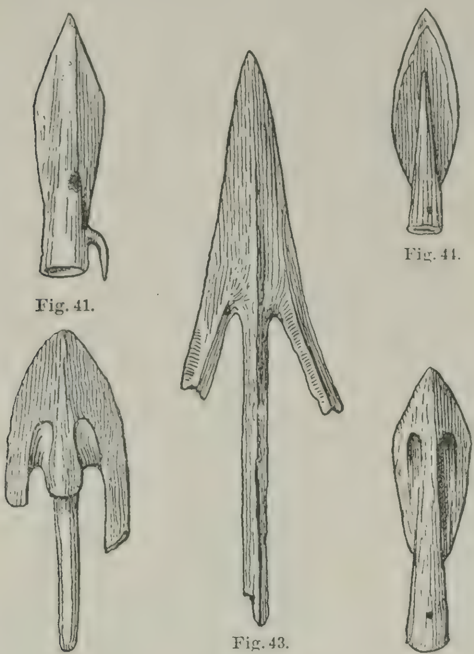


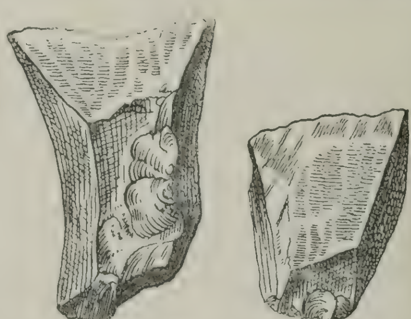
Fig. 41. Fig. 44. Fig. 43. Fig. 42. Fig. 45.

PREHISTORIC ARROWPOINTS OF BRONZE AND IRON FROM ARMENIA.

(Fig. 42) bronze, Museum of Tiflis; (figs. 41, 43) cemetery of Cheïtan-thagh; (figs. 44, 45) cemetery of Mouçi-yéri.

de Morgan, figs. 56–60. ¾ natural size.

The archæologist exercises care in his conclusions and may refuse to accept evidence of facts which would be received by the historian without or with but little question. For example, the locality most prolific with stone arrowheads known to the author, and those of the finest quality and workmanship (Plates 2 and 3), is on the banks of Lake Thrasymene, between Cortona and Perugia, Italy, near the site (itself uncertain) of the great battle wherein Hannibal so terribly defeated the Romans, killing their commander, Flaminius, and routing their army. Yet these

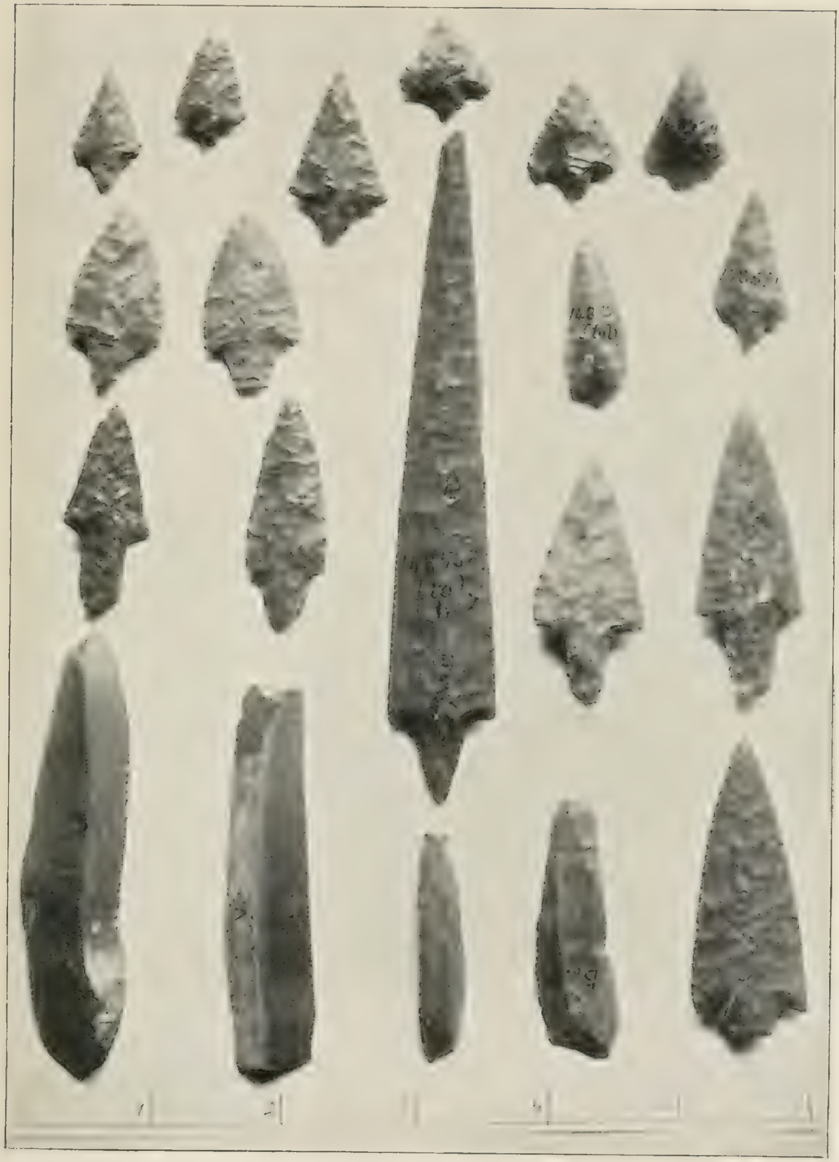


Figs. 46, 47.

PREHISTORIC ARROWPOINTS OF CHIPPED OBSIDIAN, *tranchant transversal.*

Cemetery of Mouçi-yéri, Armenia.

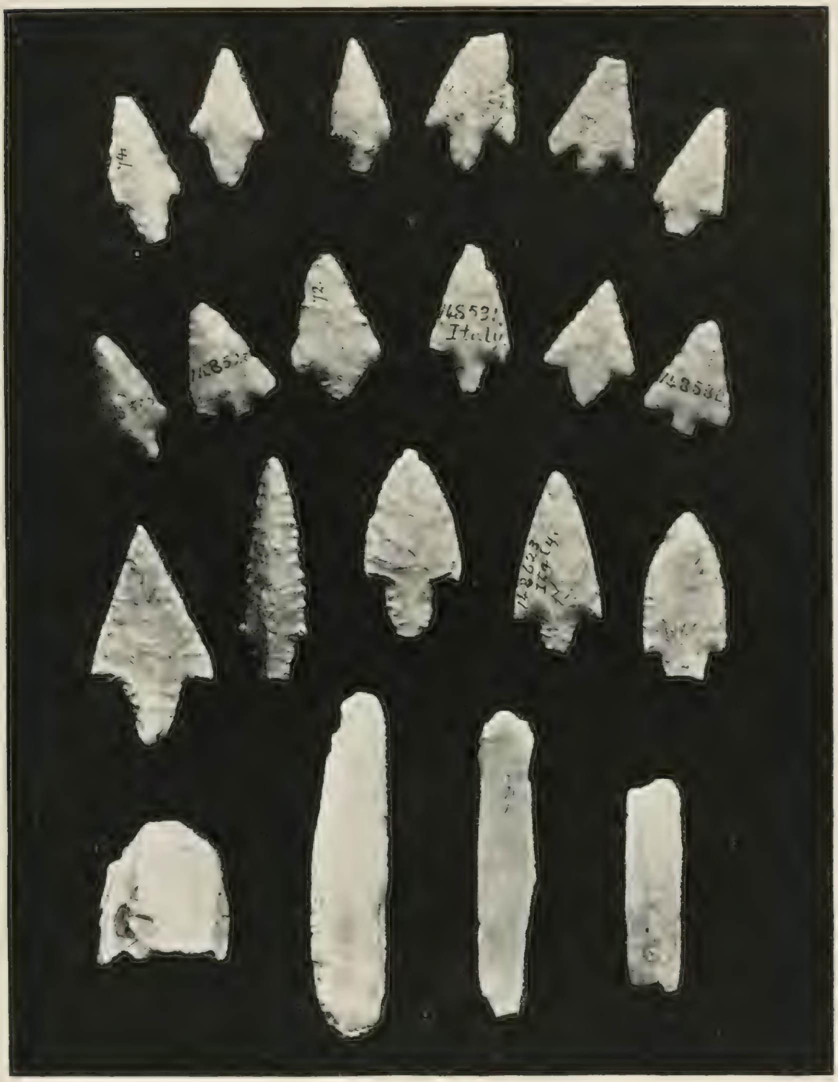
de Morgan, fig. 61. Natural size.



SPECIMENS OF FINE ARROWPOINTS.

Italy.

Cat. Nos. 148538–148556, U.S.N.M.



SPECIMENS OF FINE ARROWPOINTS.

Italy.

Cat. Nos. 148580, 148623, etc., U.S.N.M.

beautiful arrowheads found in such profusion on or so near this battlefield are believed by those archæologists who have had the best opportunity for inspection and knowledge not to have been used in that battle, nor to have had any relation to it, but belonged to an earlier epoch and another people, whether the result of a battle, the chase, or habitation of man, is as yet undecided.

III. SUPERSTITIONS CONCERNING ARROWPOINTS AND OTHER PREHISTORIC STONE IMPLEMENTS.

Antiquity of this superstition an evidence of their long disuse as weapons—Elf darts or witches' arrows—Pierre de foudre, pierre de tonnerre, pietra du fuocó—Amulets—No superstition concerning arrowheads in America—Used by Indians as weapons and only occasionally as charms.

The superstitious regard for stone arrowpoints and the belief in their supernatural origin, in most Oriental and European countries, is inconsistent with the knowledge of, or belief in, their human manufacture for use as arrows.

No people, however primitive or ignorant, having an object in common use, known by them to be of human manufacture for utilitarian purposes only, will regard it with superstitious reverence or accept it as having a heavenly origin or supernatural power. That these arrowpoints, with other objects of similar age and origin, have been so regarded by the people of the Oriental and European countries is easily demonstrated.

The superstition concerning the polished-stone hatchet and the stone arrowpoint has existed all over Europe and a large portion, if not all, of Asia and Africa; and these objects have been, and in many places still are, regarded as of a heavenly origin and as having supernatural powers. While this superstition usually belonged to the peasantry, there were many educated persons who believed it. Like the belief that the fossil animals found in the rocks were bits of broken stars fallen from the skies, until their true character was discovered by Leonardo da Vinci and Bernard Palissy, there was no way of accounting for them. So when in the nineteenth century prehistoric man was discovered, these stone implements were immediately recognized as his work, and the belief in their supernatural character began to die out. Of course, a tradition as old, as widespread, and as firmly believed among the peasantry, who read little and traveled less, would naturally be slow to yield, and so in certain localities and with certain peoples its remains are yet to be found. They have been called "lightning stones" and "thunderstones" in many languages. These names are frequently applied to both the stone hatchet[1] and the arrow-

[1] Descriptions and figures of these are given in the author's paper on Prehistoric Art, contained in the report of the U. S. National Museum for 1896, pls. 34–37, figs. 95–99.

point, though in some localities a difference is recognized and the latter are called "elf darts," etc.

It is no uncommon thing to hear older peasants in rural districts in France deny all knowledge of stone hatchets or arrowpoints or spearheads, for the sole reason that they do not recognize the objects by these names. Let one ask for pierre de foudre or pierre de tonnerre, and he would receive an affirmative answer at once. Conseiller Fornier, of Rennes, tells of a peasant who possessed one of these stone implements that he had seen come from the heavens in a flash of lightning. It struck in a neighboring field and, on his going to the place, he found the hole from which he extracted this implement still hot, and he had kept it ever since.

The belief is that these objects are protection against fire, especially lightning, and they are kept as protective amulets, some of the hatchets being drilled, while the arrowpoints are set sometimes in silver, sometimes in gold. When thus arranged they are more or less ornamental and are intended for personal use, though occasionally they are hung at the bed head, or near it, to guard the owner during sleep. The undrilled ones are placed about the house, inserted in any ledge in the stones of the fireplace, on or over the mantel, or in a crack near the door.

The terms elf bolt, elf shot, or elfin arrow are applied throughout the Scottish lowlands to the flint arrowhead. The Gaelic name, sciathee, is synonymous. In Shetland and Orkney the same idea, suggested there by the corresponding term, thunderbolt, is more frequently applied to the stone hatchet.

The elf arrow continued until a recent period to be esteemed throughout Scotland as a charm against the malice of elfin spirits and the spells of witchcraft. Sewed in the dress or worn on the person it was available for the protection of the individual, and is occasionally to be met with perforated or set in gold and silver, to be worn as an amulet.

The collection of the Society of Antiquaries of Scotland contains an "elf dart" set in silver, which has been worn as an amulet. A flint arrowhead forms the central pendant of a Greek or Etruscan gold necklace in the British Museum. Like other weapons of elfin artillery, it was supposed to retain its influence at the will of the possessor, and thus became the most effective talisman against elfish malice, witchcraft, or the evil eye. It is popularly believed when cattle are sick that they have been stricken by these fairy or elfin weapons.

> There ev'ry herd by sad experience knows
>   How, winged with fate, their elf-shot arrows fly,
> When the sick ewe her summer food foregoes,
>   Or stretch'd on earth the heart-smit heifers lie

Old country people tell odd stories of this distemper among cows. When elf-shot the cow falls down suddenly as if dead; no part of the skin is pierced, but often a little triangular flat stone is found near the

breast, as they report, which is called the elf's arrow. The cattle doctor feels the animal over and over and does not fail to find one or more elf darts in the skin. These are placed in water, which is given the creature to drink, and the cure is, of course, speedily effected.

Pennant,[1] after referring to the cure of cattle bewitched by elf shots by making them drink the water in which an elf arrow has been dipped, adds:

> The same virtue is said to be found in the crystal gems and in the adder stone; for that reason the first is called clach bhuai, or the powerful stone. Capt. Archibald Campbell showed me one, a spheroid set in silver, for the use of which people came above a hundred miles and brought the water it was to be dipped in with them, for without that in human cases it was believed to have no effect.

Pepys records, on the authority of Dr. Hicks, a circumstantial story of elf arrows with which Lord Tarbut entertained the Duke of Lauderdale, and he adds:

> I remember my Lord Tarbut did produce one of these elf arrows, which one of his tenants took out of the heart of one of his cattle that had died an unusual death.

The feats of the witches of Auldearn furnish some of the most marvelous narratives in Pitcairns's Criminal Trials. Among other disclosures, they describe a cavern in the center of a hill where the archfiend carries on the manufacture of such elf arrows with the help of his attendant imps. The latter perform the preparatory work, shaping the crude blocks and chipping the arrows out of the flint flakes, after which they receive from the master fiend their finishing form and point.

In Ireland flint arrowheads were regarded as potent spells against the influence of witchcraft and the evil eye, an elf arrow being frequently set in silver and worn about the neck as an amulet against being elf-shot.

We can not err in assuming that at the earliest period of the Northmen, exercising an influence in Scotland sufficient to assimilate the popular superstition, the period to which the flint implements pertain was only known as a state of society so different from the historic traditions with which the people were familiar, that they referred its weapons and implements to the same invisible sprites by whose agency they were wont to account for all incomprehensible or superhuman occurrences. And we may infer from what all other evidence confirms, that the close of the Scottish stone period belongs to an era many centuries prior to the oldest date of the written history of the country.

This ancient superstition is not peculiar to Scotland and Ireland. In Norway, diseases, not only of cattle but of men, were called by the name "alfshot," and in Denmark, "elveskud"—that is, elf-shot—though the flint arrowpoint is not recognized there as the bolt which furnishes the quivers of malignant elves. But other, and probably more ancient Scandinavian legends prove the existence of similar northern associations with the primitive arrowpoint.

[1] Journey in Scotland, I, p. 115.

The name still applied to the elf bolt by the Norwegian peasantry is "tordenkiler," or thunderstone, so that we can feel little hesitation in assigning to the old Norse colonists of Orkney the difference still discernible in these expressions of the same popular idea. In the Fornaldar Sogur Nordlanda, or legends from the primitive period of the north, derived from ancient manuscripts, Orvar Odd's saga furnishes a curious evidence of this. The hero, who is already furnished with three iron arrows, the gift of Guse, a Finnish king possessed of magic power, is hospitably entertained in the course of his wanderings by an old man of singular appearance.

On the side where the old man sat he laid three stone arrows on the table near the dish. They were so large and handsome that Orvar thought he had never seen anything like them. He took them up and looked at them, saying: "These arrows are well made." "If you really think them to be so," replied his host, "I shall make you a present of them." "I do not think," replied Orvar, smiling, "that I need cumber myself with stone arrows." The old man answered: "Be not sure that you will not some time stand in need of them; I know that you possess three arrows, the gift of Guse, but, though you deem it unlikely, it may happen that Guse's weapons will prove useless; then these stone arrows will avail you." Orvar Odd accordingly accepted the gift, and chancing soon after to encounter a foe who by like magic was impenetrable to all ordinary weapons, he transfixed him with the stone arrows, which immediately vanished.

The Danish collector, Olaf Worm, describes[1] the chipped flint spearheads and daggers as being of doubtful origin, and that some persons regard them as thunderbolts.

Even in Japan flint and obsidian arrowpoints are regarded as the weapons still in use by spirits. The popular belief is that every year an army of spirits fly through the air with rain and storm; when the sky clears the people go out and hunt in the sand for the stone arrowheads the spirits have dropped. Dr. Jannsen states that the Japanese keep ancient stone implements in their chapels, treating them with religious veneration. According to Dr. Schwaner, ancient stone hatchets are still more carefully preserved by the present inhabitants of Borneo in bags woven of cane and suspended in the recesses of their dwellings among their talismans and amulets.[2]

This variation in the popular mode of giving expression to the idea of a supernatural origin for these primitive weapons is worthy of note from the definite evidence it affords of a period when stone weapons were as much relics of a remote past and objects of popular wonder as now.

The collection of amulets made by Professor Belucci of Italy, shown in the Paris Exposition in 1889, contained the following, which had been worn or kept as a protection against fire and lightning: Polished-stone hatchets, jadeite 15, serpentine 12, aphanite 2, lydite, quartzite, and argillite, 1 each—32; arrowpoints or spearheads, flint 36, pyrites 4, calcite 1—41; total, 73.

The superstitious belief in these objects is not confined to any par-

[1] Museum Wormianum, A. D. 1655, pp. 39, 85.

[2] Stevens, Flint Chips, pp. 87, 88.

ticular place or country. It is equally prevalent in Germany, France, Italy, Spain, and Portugal. In Brazil these objects are called "corsico,"[1] but it is possible this may be only a name brought over from Europe by the conquistadores. In Italy they are called "pietra di fuoco," in France "pierre de tonnerre" or "pierre de foudre," in Spain "piedra de fuego" and "piedras de rayo."

A belief in the supernatural origin of stone arrows and hatchets is as common in China as it is in other parts of the world.[2]

The collection of M. Van de Poel, of 39 prehistoric objects from Java, was presented by him to the Academy of Sciences, Paris. "The specimens were obtained with difficulty, as the natives regarded them with religious veneration."[3] The Malays call them "gigi guntur" (teeth of the lightning).

This supernatural character has been recognized more or less among all peoples as far back as history goes. Sir John Evans[4] says:

> Enough, however, has been said with regard to the superstitions attaching to these arrowheads of stone. The existence of such a belief in their supernatural origin, dating, as it seems to do, from a comparatively remote period, goes to prove that even in the days when the belief originated, the use of the stone arrowhead was not known, nor was there any tradition extant of a people whose weapons they had been.

In Greece, as early as the time of Pliny, the stone arrowpoints, along with polished-stone hatchets, were believed to have fallen from the stars. The latter were called "astropelchia" or thunderbolts. Pliny, quoting Sotacus, says there are two sorts, "the black and the red, saying they do resemble halberds or ax heads. Such as be found withal are endued with this virtue, that by means of them cities may be forced and whole navies at sea be discomfited."

Aldrovandus[5] engraves a flint arrowpoint as a fossil glossopetra, a stone which, according to Pliny,[6] "resembleth a man's tongue and groweth not on the ground, but in the eclipse of the moone falleth from heaven," and which "is thought by the magicians to be verie necessarie for those that court fair women."

In the catalogue of the museum at Gresham College[7] they are called "anchorites," because of their likeness of form to an anchor. Reference is made to the collection of similar objects in the Worm Museum.

Flint continued to be used in some parts of Egypt until the twelfth dynasty, 2600 B. C. Mr. Flinders Petrie in 1889 excavated the ancient settlement Medinet Kahun, the pyramid of Usertesen II, and there found and brought back to London, where they were exhibited at Oxford Mansion, a bushel or more of flint chips and wrought flakes.

[1] Stevens, Flint Chips, p. 89.

[2] Evans, Ancient Stone Implements, p. 116; Mémoire concernant l'Histoire des Chinois par les Missionnaires de Pékin, IV, 1776, p. 474; VI, p. 467.

[3] Mortillet, Matériaux, II, p. 212; Evans, Ancient Stone Implements, p. 118.

[4] Ancient Stone Implements, p. 328.

[5] Musaei Metallici, Book IV, chap. 17, p. 604.

[6] Naturalis Historia, Book XXXVII, chap. 10.

[7] London, 1618.

Some of the flakes were inserted in a wooden sickle and made the cutting edge of the implement, while the flakes were many of them wrought (all done by chipping) into spear or lance heads. The author purchased a number of both kinds, and they are now exhibited in the U. S. National Museum (plate 4).

Sir John Evans[1] reports a chipped-flint arrowpoint fastened to its shaft with bitumen, displayed in the British Museum, found in an Egyptian tomb. The dynasty and consequently the date is not given; it may not be known.

This extended and universal superstitious regard for these implements as a class is incompatible with their use as weapons by the same people, and the antiquity of the superstition demonstrates the antiquity of their desuetude.

This superstition never attached to these objects in America, for with its discovery came also the discovery that the objects heretofore regarded as supernatural and of heavenly origin were naught but the tools and weapons of savage man. Following this discovery by the white man, came the other discovery by the Indian—that his implements and weapons could be made more easily and quickly of metal than of stone, and straightway the use of stone for this purpose was superseded by metal.

Lieutenant Niblack, U. S. N., in his "Indians of the Northwest Coast,"[2] remarks:

> On the introduction of iron, which both Cook and Dixon attribute to the Russians, the Indians were not slow to adapt it to their purpose. Dixon says that in Captain Cook's time iron implements were then also in use among the Tlingit and Haida.

And on page 209: "For salmon spears * * * steel is now generally used."

On the advent of the white man, the making of arrowpoints or spearheads of stone practically came to an end among our North American Indians, even though they remained savages. They soon found that a rejected and broken barrel hoop or other piece of strap iron would make more arrowheads than would a hundred times its weight in flint, with less labor and in shorter time. Not only were they more easily made, but were lighter; as ammunition they could be carried in greater number, and were in every way more effective as a weapon. Neither the epoch of transition from stone arrowpoints to those of iron, nor the length of time in making it, by the North American Indian, can be told with accuracy, but we may be reasonably certain that he would not long continue to make them of stone after he had the material and the tools—that is, the strap iron and a file or chisel—and the knowledge to use them. The Indian traders soon discovered the Indian needs, and after beads, glass, and tomahawks, the cargoes contained iron and sometimes files and chisels by which the arrowpoints and knives could be made, if they did not carry the arrowpoints and knives already made.

[1] Ancient Stone Implements, p. 329.

[2] Report U. S. National Museum, 1888, p. 280.

FLINT FLAKES, ARROWPOINTS, AND SPEARHEADS.

Gurob, Egypt, XIIth dynasty, 2600 B. C.

Cat. Nos. 197915-197917, U.S.N.M. Collected by W. Flinders Petrie.

This may not have begun with the first moment of contact with the white man. The first Indian trader may not have taken iron arrowpoints or the material or tools with which to make them, but we may fairly conclude he did soon after. These materials took rank in importance to the Indian with, if they did not precede, the glass beads and brass rings which have been the proverbial currency of Indian traders. There must necessarily have been a period of transition; stone arrowpoints would not be supplanted instantly by iron.

Doubtless there were exceptions to the generality of their use. Boys, amateur hunters, degraded tribes, those living far back in the mountains, even hunters or warriors moved by necessity or the desire to save expense, may have made stone arrowpoints or spearheads after general contact with the white man.

Rev. M. Eells, in the Stone Age of Oregon,[1] says stone arrowpoints and spearheads are scarce, and that he had seen only nine of them in eight years' residence among the Indians. The Indians did not make them; they used bone. But as evidence that they were used in ancient times, he says that Mr. Stevens has 3,200 of them, 6½ inches by 2¼ inches, down to one-half by one-fourth inch. He had found a grand cache of them unearthed at Oregon City. A workshop for making arrow and spearheads had been discovered at Umatilla Landing, with the usual nuclei, hammers, chips, and flakes, with arrowpoints and spearheads complete, incomplete, and broken, in abundance.

Mr. J. G. Swan, speaking of the Indians of Cape Flattery,[2] says:

> The bow is used principally by the boys * * * to kill birds and other small game; as a weapon of defense it is scarcely ever used, firearms having entirely superseded it. * * * The arrowheads are of various patterns; some are made of iron wire, which is usually obtained from the rim of some old tin pan or kettle; this flattened at the point, sharpened, and a barb filed on one side, and driven into the end of the shaft; a strip of bark is wound around to keep the wood from splitting. Some are of bone [of course the head is of wood, the same as the shaft]; * * * others again are regularly shaped, double-barbed, and with triangular heads of iron or copper, of very neat workmanship.

Lieutenant Niblack, U. S. N.,[3] speaking of the Indians on the northwest coast, says:

> To-day the bow and arrow survives only as a means of dispatching wounded game or to save powder and ball. * * * Few bows are now seen among these Indians except as toys for the children. Before the introduction of iron, arrowheads were of bone, flint, shell, or copper.

And on page 285:

> The primitive dagger was of stone or bone. The first daggers made by the natives after the advent of the whites were from large, flat files, and the skillful manner in which these were ground into beautiful fluted daggers challenged the admiration of the traders, who found the work as skillfully done as if by European metal-workers.

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[1] Smithsonian Report, 1886, p. 289.

[2] Smithsonian Contributions, No. 220, p. 48.

[3] Report U. S. National Museum, 1888, p. 286.

And the same remark is made on page 288 in regard to seal spears.

Not only was stone superseded by iron as a material for arrowpoints, but the bow and arrow as a weapon was superseded by firearms. As this was a greater change, so the period of transition might have been longer, but that it would come sooner or later was inevitable. The question of civilization has but little to do with the adoption of a better weapon. The wildest Indians in North America, having all the belongings of savagery, might have, within the past twenty-five years, been seen armed with magazine or breech-loading guns as fine and good as those of our army moving against them. These Indians and their guns represented the two extremes of civilization. The Indian was the lowest stratum, his gun the final effect of enlightenment in man.

Capt. John G. Bourke, of the United States Army, an accurate and close observer, an interested archaeologist, a noted Indian fighter who was in that service during the principal part of his life, and a valuable aid and comrade of General Crook in some of his most celebrated Indian campaigns, gave a sketch of the weapons, tools, implements, domestic utensils, amulets, etc., of certain tribes of Indians as they were when he first met them, in a paper read by him before the Anthropological Society at Washington, under the suggestive title of "The Vesper Hour of the Stone Age."[1] As resulting facts of his observations, in the twenty-three or twenty-five years of his service, since his first acquaintance with the wild tribes of the Rio Grande, the Gila, and the Colorado, he has seen them "not only subjected to a condition of peace, but notably advanced in the path of civilization, their children trained in the white man's ways, and all traces of earlier modes of life fast fading into the haze of tradition." Doubtless the North American Indian had his myths concerning the arrow. But these are quite different from the superstitions in the Old World concerning the arrowhead; those were based on the belief in the supernatural origin and power of the object, and were inconsistent with its character as a weapon. The myth in America might relate to the arrow as a charm or for divination, to find lost objects, search for game, etc., but it in no wise affected their knowledge of its having been made by man, to be used as a weapon.

On the subject of arrows as charms or amulets, Captain Bourke says[2] that all the American aborigines used stones as amulets. And he says instances of throwing arrows and stones "for luck" are given by Ross, Mackenzie, Castañeda, Picart, and Gomara. As to the myths of the arrow, he refers to Bancroft, Torquemada, Bascana, and others, and says:[3]

Arrows fired under circumstances of special note, those which had once killed enemies or in the hands of the enemy had failed to kill the present owner, became tal-

[1] American Anthropologist, III, p. 55.

[2] Idem, III, p. 62; IV. p. 73.

[3] Idem, III, p. 62.

ismans, and were worn attached to his belt, bow, or hat. Two or three arrowheads were appended to the necklace of human fingers, which I secured in a fight with the Cheyennes of northern Wyoming during the winter of 1876, and now deposited in the National Museum. The information obtained in regard to these was always vague and far from satisfactory.

With the wonderful penchant of the North American Indians for mystery, and their delight in superstition; with their belief in "medicine," the power and influence of their shamans and medicine men, and the necessity of the latter to successfully impose on their followers, it would be curious if the shamans had not attributed magic power to some of these objects. With all his experience, Captain Bourke is able to give but two instances where anything supernatural has been attributed to the arrowpoint, and these were, as he said, vague and unsatisfactory.

An Apache squaw who claimed great skill as a midwife was in the habit of administering a pinch of powdered arrow in water in cases of painful gestation or protracted labor. She explained to him that whenever lightning happened to fell a pine tree on the top of a high mountain, the medicine man would hunt for any rock at the foot of the blasted trunk which would yield fire when struck. He saw one of these medicine arrows in the possession of an Indian woman in the pueblo of Acoma, New Mexico, in 1886, and the owner acknowledged its uses to be identical with the same amulet of the Apaches, but refused absolutely to dispose of it.[1]

The manufacture and use of stone arrowpoints undoubtedly continued much later in the western countries of the United States than it did in the eastern, because that country was discovered later. It is not unlikely that there may have been Indians in the wilder countries who, in cases of stress, continued to make and use these implements into comparatively modern times. But "comparatively modern" is only a relative term. All our knowledge relating to modern savagery in America dates from contact with the white man. This contact is the line between the historic and the prehistoric. Prior to that period of contact the white man, who was the historian, had no knowledge of the Indian or his history or customs, and from that moment both his history and customs began to change.

It would follow that, unless falling within the exceptions mentioned, the common arrowpoints and spearheads in the Museum and other collections in the United States are practically prehistoric. Those from the East are admitted without question to be so, but they are no more so than those from the West. The discoveries and conquests of the Indians in the West by the whites are nearer our own times, and this accounts for the principal differences in our opinions. Contact between the Indian and the white man was the first step; the second was the obtaining of Indian lands by purchase or war, and the third was subjugation. This process proceeded faster in the West than it did in the

[1] American Anthropologist, III, p. 62.

East, and, as a consequence, the transition from savagery to civilization, from prehistoric to historic, from the bow and arrow to the rifle, has been correspondingly faster in the West than in the East.

IV. FLINT MINES AND QUARRIES IN WESTERN EUROPE AND IN THE UNITED STATES.

As all arrowpoints, spearheads, and knives, except a few of slate, were chipped or flaked into shape and used in that condition, the prehistoric man would naturally seek a material which had the requisites for such working. Flint and its kindred (the finer being chalcedony, the coarser chert and hornstone), obsidian, jasper, quartz, and quartzite were the principal substances. Obsidian is comparatively rare, and the last three were more or less refractory and would be used only when the better material could not be obtained. Flint was the best. It combined the greatest desiderata with the greatest facility of procurement, and was consequently the favorite material of prehistoric man during the polished-stone age, in Europe as well as in America. Of the 203 specimens of arrowpoints, spearheads, or knives shown in Plates 35 to 47 of this paper, 144 are of flint, chalcedony, or chert. These are all silicates of a crystalline structure, almost all cryptocrystalline. Flint can be chipped in any direction. It breaks with a conchoidal fracture, and can be struck off in long, straight, even, and thin flakes. It is tough and hard, holds a sharp edge and point, and is not difficult to work.

Quarries or mines of flint in different parts of the world were known and were worked in prehistoric times. The author proposes to describe some of the more important, preferring those which he has visited and inspected, using them as illustrations of others which will be only named. Associated with these mines or quarries are workshops where the various implements were manufactured. He also proposes to compare some of the mines or quarries and the material of Europe with those of the United States.

EUROPE.

Spiennes, Belgium.—Spiennes is a hamlet in the neighborhood of the city of Mons, in the province of Hainault. It is on the railway from Mons to Charleroi, and the station is Harmignies, the first after leaving Mons.

The author had the honor to be United States consul at the city of Ghent, in the province of Flanders-Oriental, which adjoins that of Hainault on the north, and so had opportunities of frequent visits to Mons, which is the center of an extensive mining district, principally of coal. He formed the acquaintance of M. F. Cornet, a civil and mining engineer. M. Cornet, with his colleague, M. Briart, made the report upon the prehistoric flint quarries and workshops in the province of Hainault to the International Prehistoric Congress at Brussels in 1872. The members of that congress made an excursion to this locality. There were two objects of interest; one was the prehistoric flint quar-

ries and workshops at Spiennes, which belong to the Neolithic or polished-stone age; the other was at a neighboring locality called Mesvin, where had been found evidences of the workings of man during the Paleolithic period.

The mines of flint at Spiennes cover about 50 acres, and the surface for twice that area is strewn with pieces that have been more or less worked, and are evidence of human industry and occupation in prehistoric times. M. Neyrinck collected many of these pieces, which he deposited in the Prehistoric Museum at Brussels. The first discovery of these pieces was by Albert Toilliez, who made a collection of the material, implements, tools, débris, etc., in the year 1840, which in 1865 was sold to Sir John Evans.

Fig. 48.

SECTION SHOWING GEOLOGY OF PREHISTORIC FLINT MINE.

Spiennes, Belgium.

Scale: Length, 1-5000; height, 1-1000.

RR, profile of railroad; *A*, brick clay; *B*, clay; *B'*, sandy clay with animal bones; *C*, sand containing pebbles, worked flint, débris, and bones of elephant and rhinoceros; *D*, eocene deposit of sand; *E*, white chalk with nodules of flint frequently arranged in strata; *F*, surface-disturbed earth containing débris of workshops, wrought and broken flint implements, flakes and chips, fragments of pottery, etc.; *G*, ancient pits and galleries which, when exhausted, were, to prevent accidents, filled with chalk, blocks, and earth containing wrought and broken flint implements, flakes and chips; *H*, layers of flint nodules in the chalk, followed in the exploitations; *I*, filling of kitchen refuse, charcoal, worked flakes and chips, fragments of pottery.

The discoveries of Toilliez attracted the attention of students and caused further investigations, which in 1860 resulted in the discovery of the mines of flint, and that they had been worked by prehistoric man, and that the plateau had been a vast workshop.

The flint of this locality came in modern times to be exploited for the manufacture of porcelain, and in this way the excavations of antiquity were frequently encountered. In 1867 the construction of the railway from Mons to Charleroi was begun by the way of or near to the little town of Binche. The construction of the railway required a deep cutting through the plateau between the river De Nouvelles and La Trouille. On this plateau were located the flint mines of Spiennes. The locality

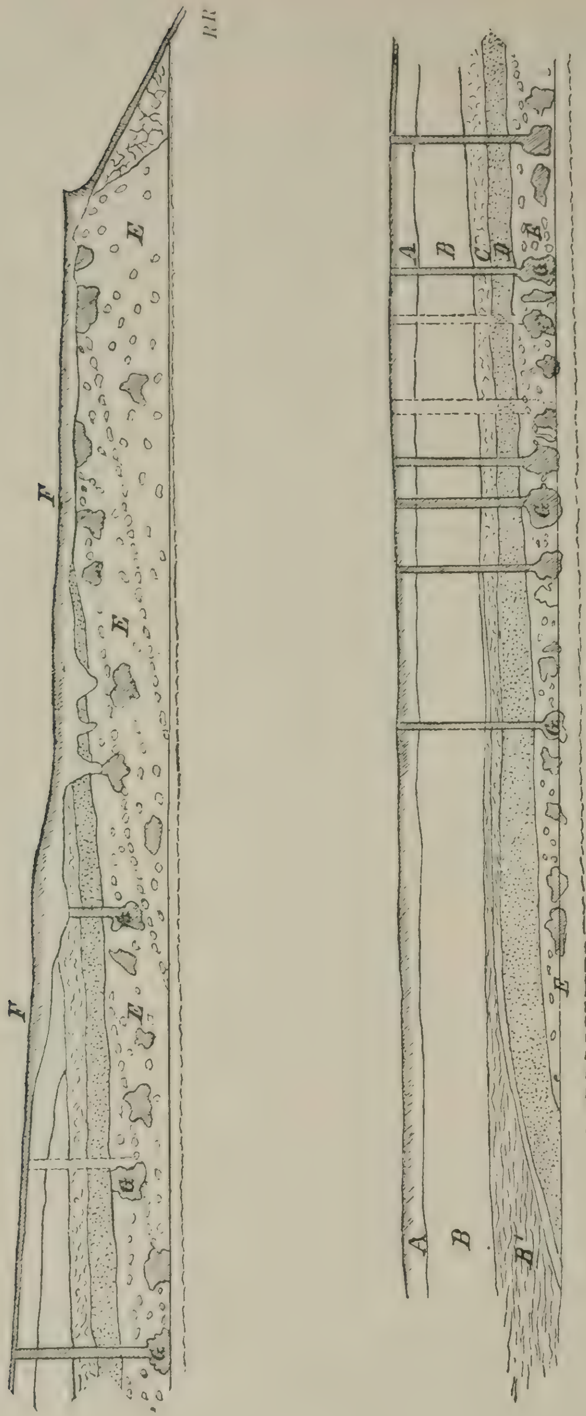

Fig. 49.

SECTION OF PREHISTORIC FLINT MINES.

Enlarged view of portion of fig. 48 from *CD* to *RR*.

Spiennes, Belgium.

(Letter of explanation of strata as in fig. 48.)

Scale, 1-500.

of the Paleolithic occupation at Mesvin is to the west of the river De Nouvelles, between it and the river Le By. A portion of the railway cut through the Neolithic flint mine at Spiennes is shown in fig. 48.

Messrs. Cornet and Briart and M. Houzeau de Lahaye were charged by the scientific society of Hainault to supervise the excavations of the railway for evidences of prehistoric man. They reported several conclusions, that which interests us being that the men of the polished-stone age had dug pits or mines into the great chalk and clay deposit to obtain flint nodules for the manufacture of their tools and weapons, and that extensive and important work had been done in these mines in times of antiquity.

The railway cut brought to light within its area no less than 25 of these pits. The cut extends about 40 feet below the surface of the plateau, which was fortunate, for it thus showed the prehistoric mines to their entire depth. These mines, as shown in fig. 49, were in the form of pits or shafts. The shaft was sunk from the surface perpendicularly through the clay and sand until it reached the chalk. The shafts were 2, 3, and 4 feet in diameter, longer than wide for facility in working, and the deepest was about 36 feet. Arrived at the chalk, galleries were thrown off horizontally in searching for the nodules of flint. The galleries were from 20 to 6½ feet in height, and from 3.3 to 9 feet in width. An enlarged view of one of these shafts and mines shows its corresponding gallery pushed to the right and left, through the chalk, in search of the nodules of flint therein contained. There are no means of determining the number of these shafts, nor the number or extent of the galleries, without an extensive system of trenching throughout the plateau, which would be too expensive; but a fair idea can be gathered of it when it is said that the entire surface of the plateau is dotted with the filled shafts. They are found every few rods. If one digs beneath the surface but little more than the depth of the plow, he will find an ancient shaft. Several of them have been excavated to the bottom and the galleries followed to their ends. The differences in the earth, filled in and natural, render them recognizable with certainty.

In fig. 50 the shaft communicated with the surface by an opening shown on the right. Whether this was natural or artificial was undetermined. The débris with which it was filled represented everything met with in the exploration. It was a confused mass of sand, lime, blocks of chalk, chips, flakes, and nodules of flint, with the bones of different animals, pieces of pottery, and not infrequently implements of bone, deer horn, and flint.

The mouths of these shafts were usually broken away around the sides, giving them somewhat the form of a funnel. But this was only for a short distance down, when the sides or walls of the pit became perpendicular (figs. 51, 52).

The pits and galleries were sometimes caved in, but usually they

had been filled by the workmen to prevent caving. One obtains great insight into the domestic and industrial life of this people by examining this filling: for, in addition to the earth and chalk which had been

Fig. 50.

SECTION OF SHAFT IN THE PREHISTORIC FLINT MINES, SHOWING ANCIENT WORKINGS AND HOW THEY WERE FILLED.

Spiennes, Belgium.

(Letter explanation of strata as in fig. 48.)

Scale: 1 inch equals 13 feet.

dug out, it contained the broken tools and implements and the refuse of his kitchen. The domestic utensils used by him during the progress of the work would be broken, used up, and cast away or lost, and so go into the refuse pile. There were bones of animals used for food,

usually split and broken for the extraction of marrow, bone points, pieces of rude pottery vessels used to cook or carry food or drink, traces

Fig. 51.

SECTION OF SHAFT IN THE PREHISTORIC FLINT MINES, SHOWING ANCIENT WORKINGS AND HOW THEY WERE FILLED.

Spiennes, Belgium.

(Letter explanation of strata as in fig. 48.)

Scale: 1 inch equals 13 feet.

of charcoal and fire with which the workmen had cooked their food or kept themselves warm. Of the tools and implements lost or broken

and cast away, were flint picks, flint flakes and points, deer antlers, and in the workshops were pieces of the knives, hatchets, arrow-points, and other implements broken in the course of manufacture—the "failures" of the workmen.

The tools used for mining were sharp picks of flint similar to cores figs. 7, 8, 9, and flakes figs. 3, 4, 5, 6 (Plate 5), probably held in the hand while digging, and picks of deer horn, one of the palms forming the handle and a prong forming the pick, such as were found at Grimes Graves by Canon W. Greenwell (Plate 6). There was no evidence in the galleries of the making or sharpening of these implements, and it was believed that this was done at the surface; nor were there evidences of the means of ascent and descent, nor yet that of lifting out the flint.

The entire plateau has been leveled during all historic time. The holes or funnel-shaped excavations which had formerly existed were

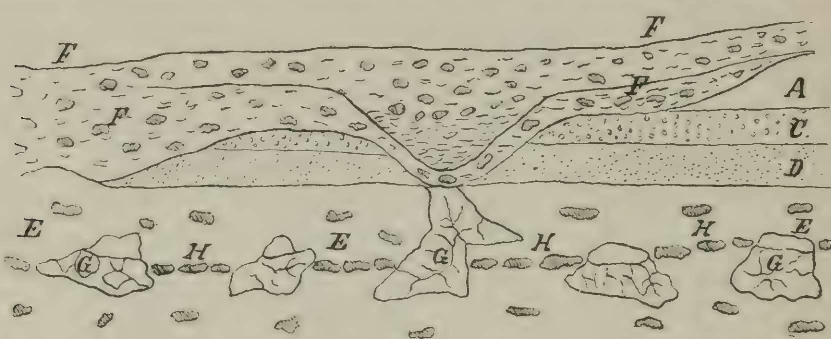

Fig. 52.

SECTION OF PIT IN THE PREHISTORIC FLINT MINES.

Enlarged view of figure, showing ancient workings and how they have been filled.

Spiennes, Belgium.

(Letter explanation of strata as in fig. 48.)

Scale: 1 inch equals 13 feet.

filled up, and the fields had been cultivated for centuries. There was nothing about its appearance to indicate its wonderful condition. The owner, the farmer, the plowman, and the hunter, all had passed over its surface from the earliest historic time without any knowledge of what lay beneath the surface, except as they derived it from the chance finds of worked flint and pottery fragments. Prior to the discovery of prehistoric man, this débris told no story and conveyed no idea. After the discovery of prehistoric man, and when wise persons became observant and sought for the evidence of his existence in the chips, flakes, and nuclei, broken and worked in every degree of manufacture, this field became a volume of evidence. During the visit of the International Archæological Congress from Brussels in 1872, its members spread themselves over the field and gathered every morsel which showed evidence of human workmanship with much the same assiduity as the miner in his search for gold. This field has always been an attraction to

EXPLANATION OF PLATE 5.

Figs. 1–6. FLINT FLAKES.
(Cat. Nos. 100256–100258, U.S.N.M. Thomas Wilson.)

Figs. 7, 10, 11. FLINT PICKS.
(Cat. Nos. 100255, 100260, 100262, U.S.N.M. Thomas Wilson.)

Fig. 8. HAMMERSTONE.
(Cat. No. 100255, U.S.N.M. Thomas Wilson.)

Fig. 9. PART OF CHIPPED HATCHET.
(Cat. No. 100264, U.S.N.M. Thomas Wilson.)

POINTED FLINT FLAKES, PICKS, HAMMERSTONES, AND CHISELS.

Spiennes, Belgium

DEERHORN PICKS.

Grimes Graves and Brandon, Suffolk, England

students of prehistoric archaeology, and has been visited by the leading authorities of that science of Europe. There has been no restriction by the owner of the land upon the carrying away of as many pieces of flint as the visitors may desire, and this permission has been used to a surprising extent. Yet when the author visited this field ten and thirteen years afterwards, pieces of worked flint were apparently in as great profusion as in the first instance. The search of a single afternoon over its surface secured such a number of these specimens that he was unable to carry them, and a peasant was employed to transport them to the railway station. So numerous were the evidences of prehistoric human industry, that despite the great desires and long-continued efforts of the farmer to rid his field of these stones, yet in many places they constituted, for a depth of 2 or 3 feet, a large proportion of the earthy material. The photographic plate of samples (Plate 5) gives a fair idea of the commoner objects, such as broken hatchets, cores, picks, hammer stones, scrapers, and flakes.

Cornet and Briart are both dead, but their places have been taken by Baron de Loë and M. de Munck, who have continued the work, and the author was fortunate enough to have heard, at the International Prehistoric Archaeological Congress in Paris, 1889, their joint paper describing the continuation of their investigation and the discoveries of the workshops supplied by flint from these mines. It was the opinion of these observers that the material had been divided up at the pit's mouth and carried to different workshops in the neighborhood, there to be manufactured into implements. The theory was advanced that these workshops had been specialized so that only one kind of implement was made in each shop or by each workman. The investigations showed that there had been a division of labor, and that each workman or each band of workmen had been confined practically to the manufacture of a single class of implements.

The hatchet was the principal implement, yet there were all kinds of scrapers, picks, arrowpoints and spearheads, and flakes in great numbers, probably intended for use as knives. These were in all stages of manufacture, from the rudest chipping to the finished (Plate 5). The hatchets were only chipped to proper form ready for polishing.

The structure of flint is such that it is better worked by chipping than by pecking. Granite and kindred material is wrought by pecking or hammering, but flint by chipping. In European prehistoric workshops most of the rough work was by chipping and not by pecking or hammering. The workshops are to be traced by the chips and refuse, and closer investigation showed them probably to have been huts, which may also have served as habitations for the workmen. There were depressions in the surface, and the ground was pounded hard, as though it had been for a floor. These observers thought they could, in some cases, discover the evidence of the wooden material of which the hut had been built. The workshops all occupied high and

commanding positions, many of which, never having been cultivated, were unchanged from the times of antiquity, and so furnish excellent evidence of their prehistoric occupation.

It was the opinion of Baron de Loë and M. de Munck that the flint implements made in the workshops of the neighborhood had been the foundation of an extensive commerce, by which they had been distributed over southern Belgium and northeastern France. M. de Munck had found 15 Neolithic stations, extending over 45 communes, all in direct relation with Spiennes, creating a network of roads which had remained in use until modern times.

Grand Pressigny.—Grand Pressigny, in the department of Indre-et-Loire, France, a few hours' ride southwest of Tours, is the center of a district rich in flint, which was much utilized during the Neolithic period.

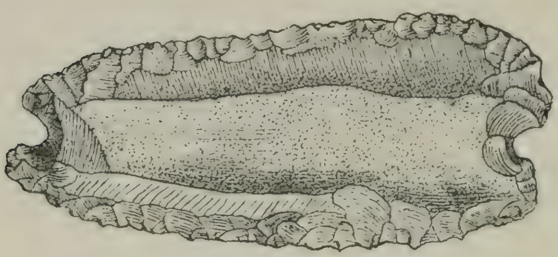

Fig. 53.

FLINT IMPLEMENT; THE PECULIAR PRODUCT OF A PREHISTORIC WORKSHOP.

Grand Pressigny (Indre-et-Loire) France.

There was no mine proper, but an extensive workshop for the manufacture of flint implements (Plate 7). The débris still encumbers the ground for miles around to such exent as to impede cultivation, and furnishes flint for the reparation of the road and for building purposes. Many of the neighboring houses have been built either with foundations or first stories of the flint nodules. The parapet of the bridge, on which we pass over the stream into the town, is of flint. The cores are most plentiful and are called, from their color and shape, "livres du beurre," pounds of butter (Plate 7, fig. 3). They have been so wrought as to enable the workmen to strike off, sometimes one, sometimes three, flakes of remarkable length, 12 to 16 inches (Plate 7, fig. 4). These flakes may have been used as knives, but they were many times worked into spear or lance heads. Here also was a division of labor, for in certain workshops these flakes alone would be found; in others, notably the hamlet of Epargne (Philippe Salmon), the peculiar saws or scrapers notched in the end were to be procured (fig. 53). But the remarkable thing about it all was the great demand in prehistoric times for these spearheads and knives and the extensive commerce they commanded. Because of its peculiar yellow or waxen color, the flint of Grand Pressigny is easily recognizable, and so can be traced in its migrations through 27 departments in northern, western, and central France, and even into some of the lake dwellings of Switzerland. Specimens of it have been found in the dolmens, associated with some

EXPLANATION OF PLATE 7.

Fig. 1. Worked Flint Flake.
(Cat. No. 99908, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 2. Large Flint Flake.
(Cat. No. 99818, U.S.N.M. Laugerie Haute (Dordogne), France. Thomas Wilson.)

Fig. 3. Flint Core.
(Cat. No. 146062, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 4. Large Flint Flake Cast.
(Cat. No. 136651, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 5. Worked Flint Flake, Point.
(Cat. No. 35163, U.S.N.M. Loire Valley, France. Gaston L. Feuardent.)

Figs. 6, 9. Worked Flint Flake, Points.
(Cat. Nos. 35201, 35202, U.S.N.M. Lake Bienne, Switzerland. G. L. Feuardent.)

Fig. 7. Large Flint Flake (knife).
(Cat. No. 35160, U.S.N.M. Preuilly (Indre-et-Loire), France. G. L. Feuardent.)

Fig. 8. Rude Flint Spearhead.
(Cat. No. 99911, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 10. Small Flint Flake (cutting tool).
(Cat. No. 99907, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 11. Rude Chipped Implement.
(Cat. No. 99917, U.S.N.M. Vendome (Loir-et-Cher), France. Thomas Wilson.)

Fig. 12. Flint Hammerstone.
(Cat. No. 99876, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 13. Flint Arrowpoint.
(Cat. No. 136586, U.S.N.M. Abruzzo, Italy. Thomas Wilson.)

Fig. 14. Flint Flake or Knife.
(Cat. No. 35161, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. G. L. Feuardent.)

FLINT OBJECTS FROM PREHISTORIC WORKSHOPS.

Grand Pressigny (Indre-et-Loire), France, and other localities in Europe.

of the earlier objects of bronze, showing that while these implements belonged to the Neolithic age, from their beauty and renown they continued in use into the Bronze age.

Mur-de-Barrez (Aveyron), France.—M. E. Cartailhac, of Toulouse, one of the best known archæologists in France, and M. Marcellin Boule, geologist, discovered at Mur-de-Barrez (Aveyron), central France, a mine of flint which had been worked in prehistoric times; and M. Cartailhac made a large plaster representation thereof, which was in the central hall of the anthropological section of the World's Fair held in Paris in 1889. Along with it were displayed the original objects of human workmanship, such as tools, implements, fragments, flakes, nuclei, and hammers, found in these mines and used by prehistoric man. It made an interesting display and gave one a thorough understanding of the subject. It was substantially a repetition in detail of the mine at Spiennes. The geologic formation was Miocene. The flint was laid down in horizontal strata after the same fashion as at Flint Ridge, Ohio. As at Flint Ridge, the prehistoric man here dug a series of pits or wells passing through the various strata, not always vertical, but at an angle, rejecting the poorer qualities of flint, one after the other, until he should arrive at the most desirable.

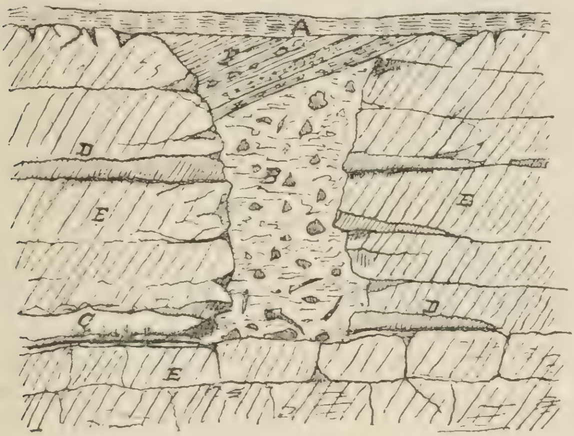

Fig. 54.

SECTION OF PREHISTORIC FLINT MINE OR PIT.

Mur-de-Barrez (Aveyron).

MM. M. Boule and E. Cartailhac, La France prehistorique, p. 138, fig. 51.

A, vegetable earth; *B*, pit excavated in prehistoric times, afterwards filled with débris containing unfinished and broken implements and flakes and chips; *C*, subterranean galleries opened by prehistoric miners following the strata of flint; *D*, stratum containing nodules of of flint; *E*, solid limestone rock; *F*, natural or accidental filling.

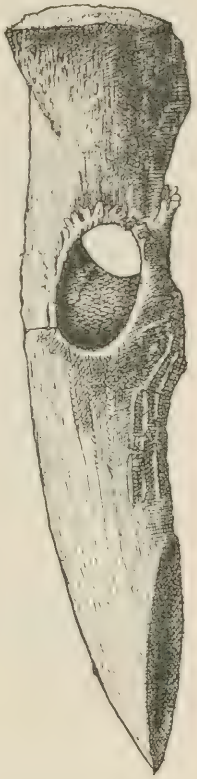

Fig. 55.

PREHISTORIC DEER-HORN HAMMER AND PICK COMBINED.

From flint mine at Mur-de-Barrez (Aveyron), France. ½ natural size.

La France prehistorique, p. 138, fig. 52.

M. Cartailhac[1] shows the working of these mines. He says galleries were carried in all directions irregularly. At the point where the flint was most plentiful and where they were to be engaged for the longest time, they left certain portions of the earth to serve as pillars of support, as is done in coal mines at the present day. The prehistoric miners took great precaution against accidents; they filled all cavities and interstices after they had taken out the flint, to the end that there should be no caving, but there were no traces of shoring up with timbers.

Fig. 56.

SECTION OF PREHISTORIC FLINT MINE.

Meudon (Oise), France.

Discovered in 1822 by Cuvier, wherein he found a deer-horn pick.

La France prehistorique, p. 139, fig. 53.

Notwithstanding all this care, Boule and Cartailhac found evidences of caving; for example, the implements of deer horn were found crushed by the falling of some portion of the roof which had not been properly supported. The strokes of these picks of the workmen were plainly visible on the walls of the galleries. Occasionally one could find the points still incrusted in the rocks where they had broken off. The miners had kindled fires in the galleries and used the heat to break up the blocks of flint to facilitate their extraction and transport. Some of them bore evidence of the cords and strings which had been used in carrying them. These prehistoric mines were brought to view by the opening of a limestone quarry. The mine is shown in fig. 54, and one of the deer-horn picks is represented in fig. 55.

Meudon (*Oise*), *France.*—Fig. 56 represents a similar mine from Meudon reported by Cuvier, and figured by him and Brogniart in 1822.[2] The interest to him was the deer horn found therein; the interest to us is that it was the work of man at a period to which Cuvier had refused his belief upon a-priori theory.

Champignolles (*Oise*), *France.*—A prehistoric mine of flint was discovered by Fouju and Bessin in October, 1890, and described in 1891.[3]

[1] La France prehistorique, p. 138, figs. 50–52.

[2] Idem, p. 139.

[3] L'Anthropologie, II, 1891, p. 445.

It is cited here to show how these discoveries of mines, quarries, and workshops are being continued. If more earnest search were made, more mines and workshops would be discovered. It has come to be a canon in archæologic law, recognized in France, that the evidences of prehistoric man are to be found, not in proportion as they exist, but in proportion to the number and activity of the seekers. The nodules of flint at Champignolles were in the chalk and were mined and worked into implements. Twelve pits were found, of which nine were excavated and exposed. A section is given (fig. 57) which will sufficiently explain its condition.

Grimes Graves, Brandon, Suffolk, England.—These are flint mines or quarries, celebrated under the ancient name of Grimes Graves and in modern times under the name of Brandon. They have been worked for hundreds of years to make gunflints and strike-a-lights. There are similar manufactories in many places in Europe. Besides Brandon, flints are made at Ichlington, Suffolk, at Norwich and Salisbury, England; at Meusnes, in France, and at Cero, Italy. In former times the business was of such importance that in France exportation of the products of certain mines was prohibited by law. In the later days the demand has fallen away so as to have become insignificant, yet Brandon leads the world. The strike-a-lights are continued in use by peasants and laborers, and by explorers and travelers in semicivilized countries. Sir John Evans visited Brandon in 1866 and Mr. James Wyatt in 1870, both of whom have described the mines.[1] At those periods there were twenty or thirty persons engaged in the business. The raw material costs, for mining, royalty, cartage, etc., about $2.50 a ton, and manu-

Fig. 57.

SECTION OF A PIT OF THE PREHISTORIC FLINT MINE AT CHAMPIGNOLLES (OISE), FRANCE.

L'Anthropologie, II, No. 4, 1891, p. 448, fig. 3.

A, blocks of chalk used for filling; *B*, argillaceous earth; *C*, vegetable earth; *D*, solid chalk bed with flint nodules; *E*, a line of charcoal; *F*, flint chips, débris of workshop; *G*, a hatchet chipped for polishing; *H*, deer-horn picks, implements, etc.

Scale: 1 inch equals 6 feet.

[1] Ancient Stone Implements, p. 14; Flint Chips, p. 578.

factured flints sold at about $1 a thousand. The price the author paid for strike-a-lights in Bologna was 1 cent apiece. In Paris the flint was arranged with steel and cotton soaked in some chemical, possibly saltpeter or chloride of potash, for tinder, the complete article costing 60 cents (fig. 58). The gunflints of commerce were divided into 23 classes, according to size and shape as they were required for different arms. In the palmy days of the flint makers they were packed for export in half barrels, each containing 2,000 musket, 3,000 carbine, or 4,000 pistol flints, the weight of each being about the same, 65 to 70 pounds. Their manufacture required some skill and handicraft, although it is soon acquired. There is great difference reported in the rapidity of the workmen.

The working of the Brandon flint mines has continued into modern times for the manufacture of gunflints. The process of making them has been described at length in various works.[1] It will be sufficiently

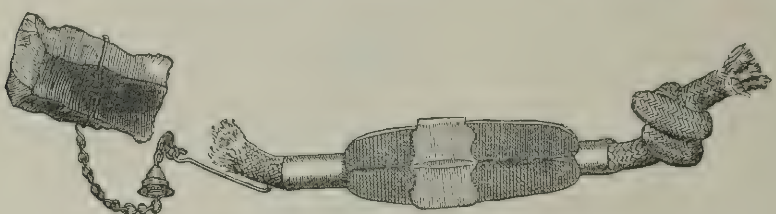

Fig. 58.

"STRIKE-A-LIGHT," STEEL AND TINDER, USED BY FRENCH PEASANTS.

Paris, France.

Cat. No. 129693, U.S.N.M.

understood by Plates 8–10, which show the principal operations. Sir John Evans says skilled workmen at Brandon could make from 16,000 to 18,000 a week, and that the average weekly output was from 200,000 to 250,000 for 20 men. In Rees's Encyclopedia,[2] it is estimated that one a minute was the average for a good workman. That would make the extreme weekly product of 20 men but 72,000.

The U. S. National Museum possesses a series of nodules, crudely and partly worked, from Brandon, showing the entire operation.

The Grimes Graves quarry was investigated by Canon Greenwell, of Durham Cathedral, in 1870, and his report is published in the Transactions of the Ethnological Society for that year (p. 419).

The quarry covered about 20 acres and consisted of shafts or pits partly filled, now forming funnel-like depressions, 254 in number, 20 to 60 feet in diameter, dispersed over the surface but sometimes so close together as to break into one another. It required much work to reexcavate them. The shafts or pits chosen by him were about 30

[1] Evans, Ancient Stone Implements, p. 18; Stevens, Flint Chips, p. 578; Rees's Encyclopedia, article "Gunflints," and Skertchly, Manufacture of Gunflints.

[2] Article "Gunflints."

FLINT KNAPPER ENGAGED IN QUARTERING FLINT.

(Observe hammers, pad on knee of operator, flints lying about, old iron lantern and hanging iron candle-stick.)

Brandon, Suffolk, England.

FLINT KNAPPER FLAKING THE FLINTS INTO LONG SLIPS.

(Observe hammers, tub of flakes, flint chips, iron flint pick and its neolithic deer horn original.)

Brandon, Suffolk, England.

KNAPPING THE FLAKES INTO GUN FLINTS.

(Observe hammer, the blocks, cans of assorted gunflints, manner of holding and striking the flake, waste chips of flint, etc.)

Brandon, Suffolk, England

feet in diameter at the surface, 13 feet at the bottom, and originally about 40 feet deep. Similar pits or funnel shaped depressions abound

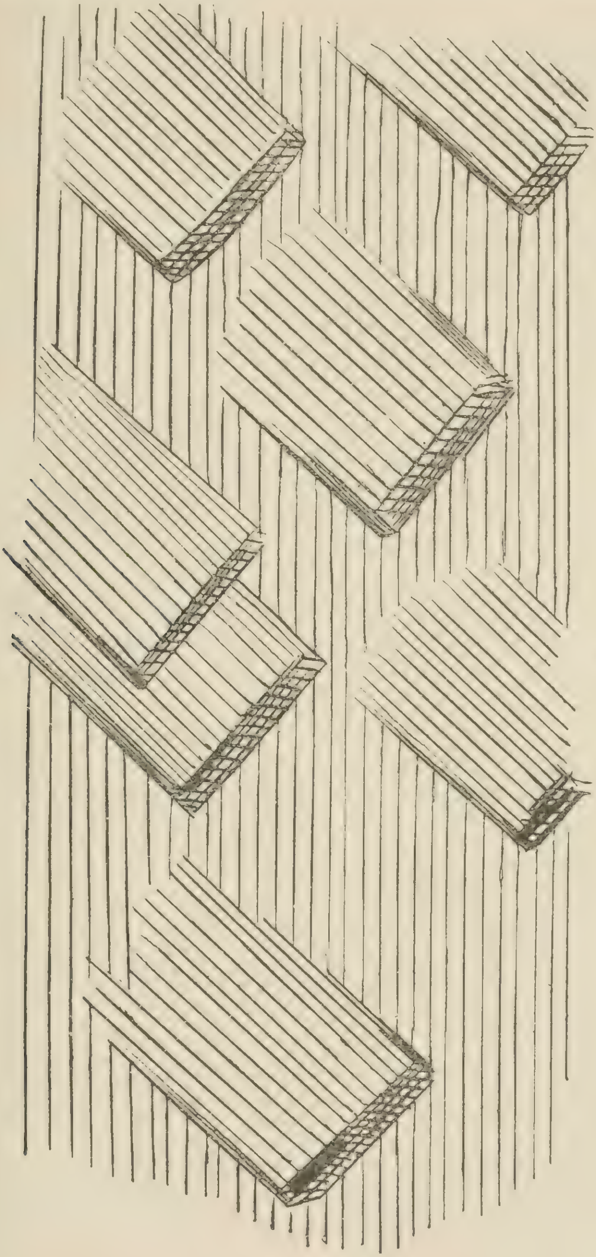

Fig. 59.

PREHISTORIC PICK MARKS IN THE HARD CLAY IN THE EXCAVATION OF AN ETRUSCAN TOMB.

(Del Colle Cassuccina) Chiusi, Italy. Illustrating the pick marks in the chalk at Grimes Graves, England.

at the quarry at Flint Ridge, Licking County, Ohio. As at Spiennes, the workmen passed through a stratum of flint, which was rejected as

of an inferior quality, and the pits continued until they reached the best flint in the chalk. The first surface of earth stratum was some 18 feet thick, which might account for the inability to make perpendicular walls or pits as at Spiennes. As at Spiennes, they drove horizontal galleries into the chalk which here were about 3½ feet high. At Spiennes, the digging tools were principally flint points (Plate 5, figs. 7, 8, 9) and flakes; here they were red deer horn, of which about 80 were found by Canon Greenwell (Plate 6). The points of these were worn as picks, and the bases were battered by use as hammers. Canon Greenwell says the marks of the deer-horn picks made by digging were yet plainly visible in the chalk. A hatchet of basalt had been thus used and made its marks at Grimes Graves. The author saw corresponding marks in the hard clay in the Etruscan tomb (del Colle Cassuccina) at Chiusi, and made a drawing of them, represented in fig. 59, which will serve as an illustration of those at Grimes Graves and elsewhere. The deer-horn pick handles at Grimes Graves were worn smooth by the hands of the workmen, as are pick handles at the present day. The roof of one of the passages had caved during the absence of the workmen, who had left their tools, two deer-horn picks, apparently at the close of the day's work (Plate 6). Here they were found by Canon Greenwell during his excavations, and the coating of chalk dust on one of them retained the print of the man's hand. "It was a most impressive sight," he said, "never to be forgotten, to look, after a lapse of three thousand years or more, upon a piece of unfinished work with the tools lying about as though the workmen had just gone to dinner or quit work the night before."[1]

Sir John Evans enumerates the various tools, implements, and débris found in the fillings in the shafts and galleries and on the surface in the immediate neighborhood; cores, chips, and flakes of flint, quartzite and other pebbles used as hammers, hatchets, scrapers, borers, and arrow and spear heads, some of them more or less rude, some broken, and in all stages of progressive manufacture.

Prof. W. Boyd Dawkins[2] says the surface was covered by innumerable splinters and implements in every stage of manufacture, from the nodule spoilt by an unlucky blow to the article nearly finished and accidently broken. There were as at Flint Ridge (Plate 13), little heaps of small splinters which marked the places where the finer work was carried on. In some of these the two halves of broken implements were found just as they had been tossed aside by the workman (Plate 11, fig. 7; Plate 14.)

Cissbury, Sussex, England.—These are extensive flint mines worked, as were the others, in ancient times. They were first investigated in 1869 by General Pitt-Rivers.[3] His plan of the camp and mines is shown

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[1] Transactions of the Ethnological Society, 1870, p. 437.

[2] Early Man in Britain, p. 279.

[3] Archæologia, XLII, pp. 44, 54.

EXPLANATION OF PLATE 11.

Figs. 1, 4. Flint Scrapers.

(Cat. No. 99885, U.S.N.M. Dorchester, England. Thomas Wilson.)

Figs. 2, 3. Rude Flint Picks.

(Cat. No. 139107. U.S.N.M. Prehistoric mines at Grimes Graves, Brandon, Suffolk, England. Edward Lovett.)

Figs. 5, 6, 8. Worked Flint Flakes (fine).

(Cat. No. 99870, U.S.N.M. Dorchester, England. Thomas Wilson.)

Fig. 7. Rude Chipped Hatchet or Chisel.

(Cat. No. 139072. U.S.N.M. Prehistoric mines at Grimes Graves, Brandon, Suffolk, England. Edward Lovett.)

IMPLEMENTS FROM FLINT MINES.

England

in fig. 60. The mines were subsequently investigated more in detail and by excavation and clearing out the now filled galleries. This was done by Mr. J. Park Harrison.[1] Fig. 61 is a reproduction of the plan of his excavations. It represents but an infinitesimal portion of the mined area. It shows but six pits or shafts, while fig. 60 shows them to have existed by the hundred. These pits present on the surface much the same appearance as those at Flint Ridge. The excavations in fig. 61 show what has been suspected long before—that these pits are deep, going down through the chalk to the bottom of the flint deposit, and were thence carried in horizontal galleries as in all mining under similar

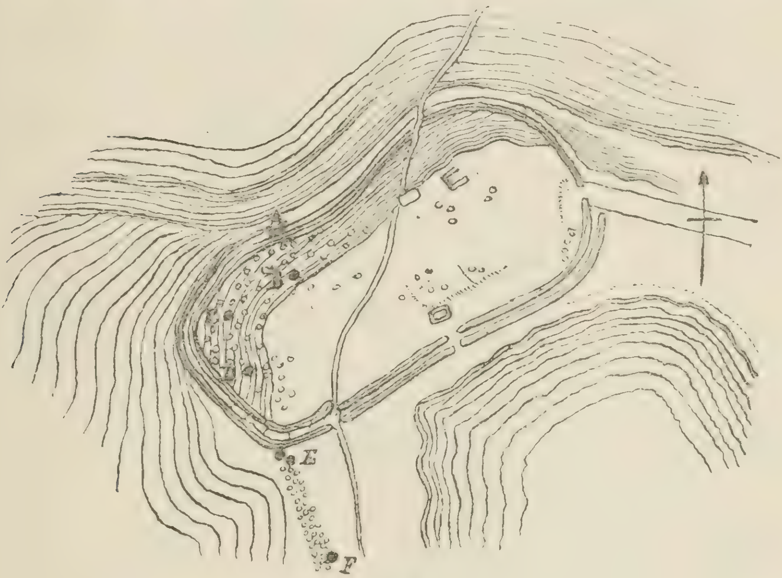

Fig. 60.

PLAN OF PREHISTORIC FLINT MINES.

A to *F* are pits or mine shafts.

Cissbury, England.

Archæologia, XLII, 1869.

conditions, digging out the flint and bringing it to the surface for use. Fig. 61 is introduced to demonstrate this fact, and also to show the extent and magnitude of the work done and to suggest the social condition of a people capable thereof. The shaded lines show the walls of the galleries left for support, while the white between shows the excavated galleries, rooms, and halls. The reexcavation brought to light not only the stratum of flint to be mined but showed that which had been mined, also the mining tools, as deer-horn picks, stone hammers, and mauls.

Only three or four out of the thousands of implements found at Cissbury bear traces of polishing, and these were broken.

[1] Journal of the Anthropological Institute of Great Britain and Ireland, VII, 1877-78, p. 413.

In all prehistoric mines and workshops throughout Europe tools and domestic utensils, flint or horn picks, chips, flakes, traces of charcoal, hammers, partially made and broken hatchets, and other implements, as sawed horn and fragments of pottery, are found (Plates 5, 7, 11),

Fig. 61.

PORTION OF PLAN OF PREHISTORIC FLINT MINES.

(Enlarged and in greater detail than fig. 60.)

Cissbury, Sussex, England.

Jour. Anthrop. Inst., London, VII, 1877-78, p. 413.

and are evidences of human occupation. If man worked in one of these places for any length of time he used his tools for his work, and domestic utensils for his cooking and living, and they were broken or lost, and so found their way into the dump pile. These utensils have

come to be expected by the modern investigator, and are found wherever prehistoric man occupied the locality for any length of time.

In Rees's Encyclopedia[1] it is said that the best flint found in France in modern times is that from the departments of Cher, Loir-et-Cher, Ardèche, Yonne, and Oise. M. de Mortillet has discovered in the department of Vienne no less than 44 Neolithic workshops, and in Indre-et-Loire 9. M. Philippe Salmon reports prehistoric workshops in 14 communes in the department of Yonne. This number would undoubtedly be much increased if attention were given to the search and if all found were reported. Special workshops have been found where particular implements were exclusively manufactured. De Mortillet reports[2] hatchets chipped for polishing from Mariettes at Londinières (Seine-Inférieure), Olendon (Calvados), Forêt Othe (Yonne-et-Aube); perforators, Nemours (Seine-et-Marne); arrowheads, Camp de Chassey (Saône-et-Loire). While arrowheads are in profusion in the latter locality, it is not certain that they were manufactured there.

The following mines have been found wherein scrapers were the special product: Roche-au-Diable, Potigny (Calvados), Charenton (Seine), Camp-Barbet, Meudon, Janville, Mouy (Oise), Goalenec, Quiberon (Morbihan). Of the latter the author asks indulgence for a few words of description, as he was present with M. Gaillard and assisted at the discovery.

Scraper workshop at Goalenec, Quiberon (Morbihan), France.—It was on the extreme point of the promontory of Quiberon, on the west coast of Brittany, looking out upon the Atlantic Ocean, but which English geographers have arbitrarily called the Bay of Biscay—a high rocky point, level with the surrounding surface, but 40 or 50 feet above the water. It was severed from the mainland by a crevice a few feet in width, passable only at low tide. The entire mass was of granite rock. It was covered with a layer of soil which was nearly bare on the side toward the ocean, having probably been denuded by the waves, but on the inside edge was 3½ feet thick. Beginning at the outside edge, screening, examining, and throwing the dirt behind us, bits of broken and wrought flint and fragments of pottery were soon found. We saved everything. Our work continued across the point until we had thousands of objects, principally scrapers in all stages of manufacture. It was a prehistoric scraper workshop. The peculiarity of these scrapers was their diminutive size; many, perfectly finished, were no larger than a man's thumb nail. At the edge farthest from the ocean, where the soil was deepest, we unearthed the skeleton of a workman, a man of middle age, he who probably had made these prehistoric implements, who had here lived and here died, and had been buried in his workshop and habitation, which was from that time deserted, and now discovered and unearthed by us.

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[1] Article "Flint."

[2] Le Préhistorique Antiquité de l'Homme, p. 490.

In addition to the skeleton the following objects were found: Three polished-stone hatchets of diorite, entire; 14 hatchets, fragments, unfinished; 7 pendants of stone; 3 beads, talc; 3 chisels, hatchet (?) of diorite; 5 flakes, flint; 6 chamfered polishers, schistose diorite, unique; 1 briquet, "strike-a-light," iron pyrite;[1] 4 sinkers, scrapers in all stages of progress, many of them finished, and hammers of various kinds and styles. There were divers tools, ornaments, domestic objects, etc., not necessarily connected with scrapers or their manufacture. They were the objects used by the workmen while engaged in their duty.

The author took for his share such objects as he desired, and has had photographed a series of them (Plate 12). Observe that on the left are the finished and on the right the unfinished scrapers.

UNITED STATES.

Flint Ridge, Licking County, Ohio.—This is probably the most extensive and the best known of all prehistoric flint quarries in the United States. It is on a high, level plateau on the road, equidistant between Newark, Licking County, and Zanesville, Muskingum County, Ohio, lying partly in both counties (Plate 13). Its ridge is about 8 miles east and west and 2½ north and south. The outline of the plateau is exceedingly irregular. The surface of the country has been greatly eroded, the streams having cut down about 300 feet below the original level, washing deep ravines, which run up into the plateau with steep banks, leaving high, jutting points of land. The covering earth of the plateau is alluvial—clay, shale, etc.—and lies directly on the stratum of flint. The stratum of flint dips to the southeast, as do nearly all formations in eastern Ohio, while the surface of the plateau holds about the same level. The top of the flint stratum at the western end is 3 or 4 feet beneath the surface; at the eastern it is 8 or 10 feet, and the layer itself is from 4 to 7 feet in thickness throughout the plateau.

Mr. Gerard Fowke describes the geology of Flint Ridge as follows:[2]

> In the geological scale this flint is continuous with the ferruginous limestone of southeastern Ohio, and is highly fossiliferous in some places. In the museum of the State University is a very fine nautilus embedded in a piece of buhrstone from this place. Other smaller fossils occur abundantly both in this and the more solid flint, particularly *Fusulina cylindrica*, a small foraminifer found in great numbers in Europe at a corresponding horizon. Very frequently, however, the fossil, being calcareous in its nature, has disappeared, and only the matrix remains.
>
> Underneath the flint lies the Putnam Hill limestone of the Ohio survey, so named from a high hill opposite Zanesville, where it is well shown. The upper part of this limestone is shelly, sometimes closely approaching a thin sandstone in its appearance, and of a yellow cast; farther down it becomes more solid and takes on a blue color.
>
> The flint, from its great resistance to weathering agencies, forms the cap rock of the whole ridge, the superincumbent material being for the most part either clay or

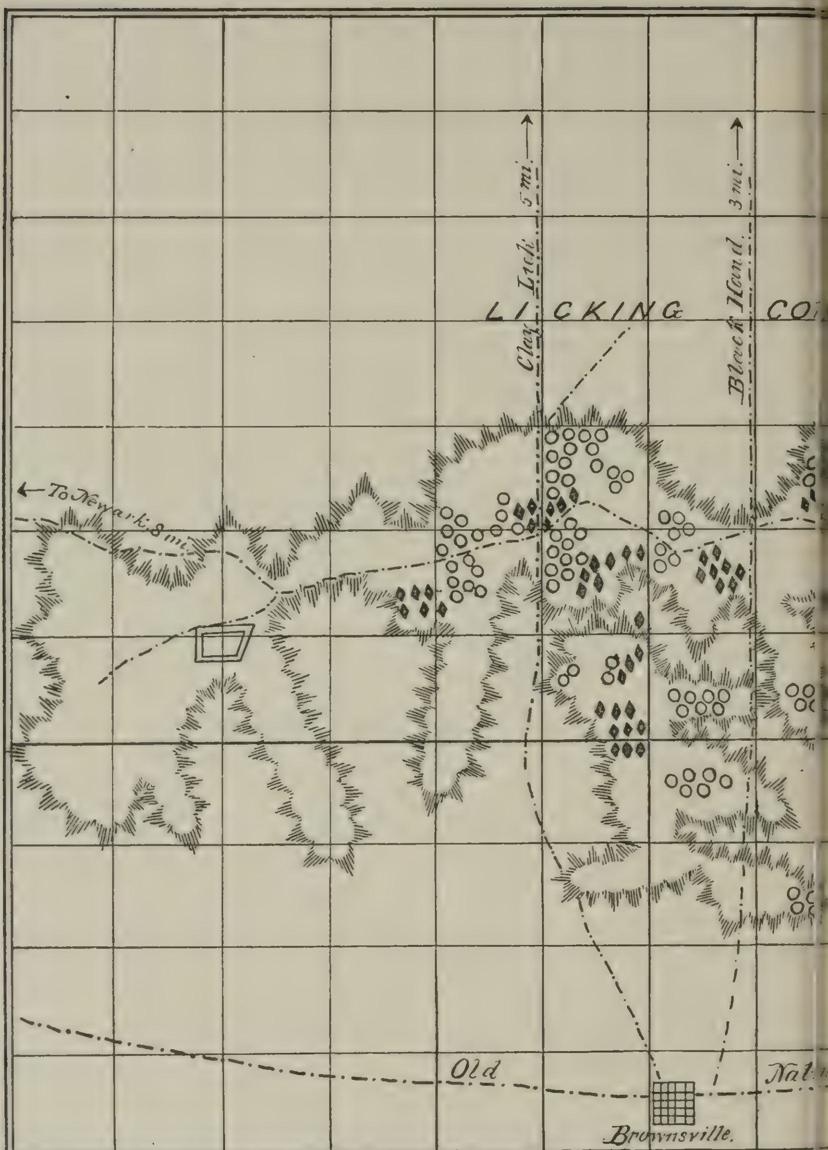
[1] Similar to fig. 223, Evans, Ancient Stone Implements.

[2] Smithsonian Report, 1884, pp. 856, 857.

CACHE OF SCRAPERS.

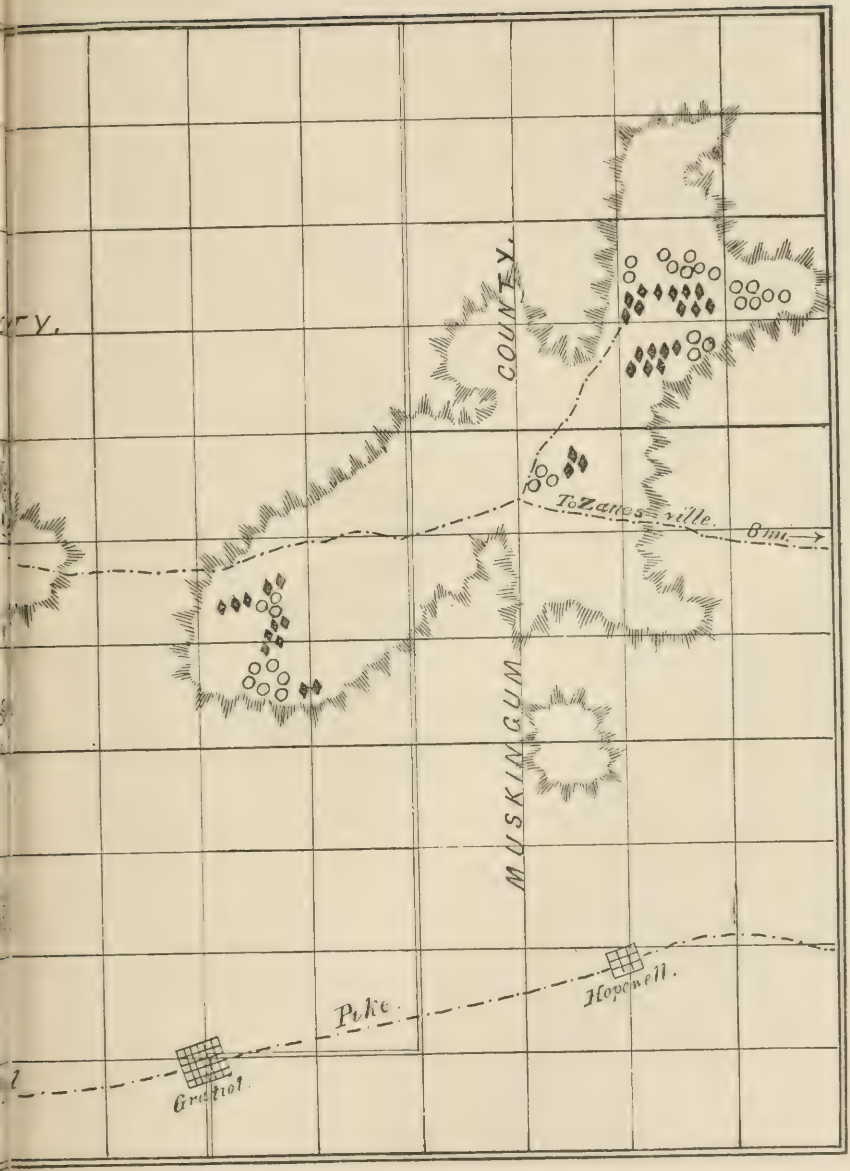
Goalenec, Brittany.

Cat. Nos. 100046, 100047, 100058, 100271, U.S.N.M.



MAP OF FLINT RIDGE, OHIO, SHOWING

O. Pits



…IGINAL FLINT QUARRIES AND WORKSHOPS.

…Workshops.

soil resulting from the disintegration of the shales and sandstones which formerly existed at this horizon. The natural place of the Kittanning coal of the Pennsylvania series is 15 to 20 feet above the level of the flint, but it runs out before reaching this far west, at least there is no trace of it here. These beds of bituminous coal lie at different levels in the hills; 104 feet below the flint is a workable seam of cannel coal. A section of the formation in the eastern part of Licking County shows the same alternation of sandstone, shale, clay, coal, limestone, and iron ore that is found in all coal regions, so that a detailed statement of its geological structure is unnecessary.

Mr. Fowke describes the variations of the flint as follows:[1]

At the extreme western end it is of a gray, whitish color, cellular or porous in structure and commonly called buhrstone, and in the early occupation by white man had been quarried for use as millstones. By the oxidation of the included iron it shows shades of yellow brown along the line of fracture. Half a mile east appears the translucent and bluish variety; still the buhrstone predominates. Two miles farther east, while the bed rock retains the bluish cast, the surface specimens by weathering show every color known to flint—white, black, brown, yellow, green, and blue.

At the intersection of the crossroads, the Clay Lick Station road, the well diggers report the flint as translucent and light-blue. A few hundred yards to the north it is nearly white; the same distance south it is nearly black. These varieties are found in other parts of the plateau and finally finishes at the extreme eastern end with the same buhrstone that it commenced. In the crevices are frequently found quartz crystals. They are of every size from microscopic to that of a hen's egg, and of every color from limpidity to almost black.

The flint was found to be in a continuous stratum, not in nodules. It may have had fractures and faults, but was practically a solid mass from 3 or 4 to 7 feet thick (in one place it was only 29 inches), with an area 8 by 2½ miles. The central portion only was worked, except some scattered diggings on the east in Muskingum County. The worked area was about 2 miles square, and was covered with clay and soil to a depth of from 4 to 8 or 10 feet.

The prehistoric mining is believed by Mr. Fowke, who has examined it with great detail and thoroughness, to have been conducted in the following manner:

The clay and soil covering was removed by digging and carrying up on the level. This digging, continued down to the layer of good flint, naturally made a pit with sloping sides like an inverted cone, with its point resting on the flint layer; the point would be more or less truncated according to the width of the excavation, which was from 15 or 20 feet up to 60 or 80 feet. In some places these pits were so close that they ran together and the earlier was partially filled with the débris from the later. Many have been filled with soil, leaves, etc., and, having retained the rain water, are now filled with muck and become veritable marshes; in others the water is more or less pure and has been used for watering cattle.

The flint being laid bare in the manner indicated over a greater or

[1] Smithsonian Report, 1884, p. 857.

less area, Mr. Fowke's belief is that the prehistoric man was unable to quarry or break pieces or blocks of flint suitable for use off the solid layer at his feet, and that he proceeded by the use of fire and water alternately to erode a hole or pit through the flint. Arrived in this way at the bottom of the layer of flint, he then broke out from the face of the flint wall and threw away such pieces as had been affected by the fire, until good flint was procured, which was taken out for use. The process was continued until the quarrying was interfered with by the superincumbent earth. Why this was not excavated wider and the quarrying continued against the face of the rock, instead of what seems to have been the practice, opening a new pit through the clay, and a new hole through the flint, has not been explained; but that he conducted his operations in the latter manner and not the former seems established. Mr. Fowke says:[1]

In Coshocton County, near Warsaw, are some similar pits which have been reopened by residents of the locality. In them were found two layers of flint, the upper a dark variety, the lower a clear, translucent kind of chalcedony. This lower flint seems to have been the kind sought. Traces of fire were plainly visible in the pits, from which the inference is natural that fires were built upon the rock, and that, while heated, water was thrown on it. The stone could thus be broken into pieces. In the bottom of the pits were found bowlders of granite, syenite, and other glacial rock, which plainly showed that they had been used as hammers. No doubt a similar plan was followed at the ridge.

Similar hammers were found at Flint Ridge, and there is in the U.S. National Museum a series of a hundred or more, varying in weight from 6 ounces to 20 pounds. The smaller hammers were found distributed over the surface at the workshops where the raw material was carried to be worked into implements. Mr. Fowke is of the opinion that there were at Flint Ridge two kinds of workshops, one for the ruder work of blocking out the implements, and the other for the finishing; and he assigns this division of labor to eight localities for each, all on the plateau of the ridge. Without expressing an opinion as to the correctness of this division of workshops, the author can testify that some localities of the neighborhood were strewn with ruder and heavier material, while others had a profusion of small and fine chips, flakes, and débris, evidently the product of the finer finishing work. The latter localities were mostly on the high bluffs or points of land overlooking the valleys below, and from which position one could see far over the adjoining country. On these points the flint chips, flakes, etc., were in such profusion as, in some cases, to prevent the grass forming a sod. The author chose one of these spots and dug it out 10 by 12 inches and 14 inches deep to the bottom of all flint débris. He then washed out the earth. The flints were 7 inches deep and the earth 7 inches, half and half. The flints from this hole were brought to the U. S. National Museum. The accompanying plates (14 and 15) show

[1] Smithsonian Report, 1884, p. 864.

WORKED FLINTS FROM WORKSHOP.

Flint Ridge, Ohio

Cat. No. [illegible], U.S.N.M.

FLINT CHIPS FROM WORKSHOP.

Flint Ridge, Ohio.

Cat. No. 149988, U.S.N.M.

the number, kind, condition, and appearance. A count showed as follows:

Plate 14:	Perfect arrowheads		51
	Leaf-shaped, perfect	9	
	Leaf-shaped, imperfect	16	
			25
	Cores, finely wrought		15
	Rude lumps of flint		34
Plate 15, débris:	Hard burnt clay, small	2	
	Pebbles, not of flint, small	13	
	Bits of wood, small	5	
	Chips and spalls, flint	3, 149	
			3, 169
	Total contents of hole 10 by 12 by 14 inches		3, 294

This quarry was the largest in that portion of the United States. The investigations show it to have been used during the later prehistoric ages and that it was the center of an extensive commerce. The peculiar appearance, variegated color, brilliancy, etc., of its products enabled their migration or commerce in prehistoric times to be traced and the objects to be recognized whenever found.

There were many mines and quarries in the territory now the United States which furnished material for aboriginal stone implements. Some of them may have continued to be used by the savages in more modern times, but most of them are entirely prehistoric. It is needless to describe them, but the reports of their discoveries have been collected and are published for the convenience of students. They form part of Appendix A (p. 961).

CACHES.

The only method possible for the savage to preserve property left behind him on his departure was to secrete it, and this was usually accomplished by burying it. This custom prevailed among the prehistoric peoples of Europe as well as of America. By what name the savage called this deposit is not known, or if known is not used. In English it has been called deposit, hoard, etc., but the most popular word is the French one of cache. It signifies concealment or hiding, and was first employed in America by the early French Canadians, the coureurs du bois, being applied to a concealed or deposited hoard or supply, usually of provisions, in which sense it is used in many of the early histories and travels in Canada and the lake regions.

In forming a cache or hoard of implements, no general or uniform method was followed, but they have been so deposited as to show intentional placement. Usually they are in a circle, and may be laid flat or on edge, sometimes on end.

Reports of caches have been made by their discoverers, and for the convenience of the student these have been collected and are published in Appendix B (p. 970).

Implements of the leaf-shaped class have been found *en cache*, or

buried in the earth, and have been called by some persons, "cache implements." M. de Mortillet names them generally Solutréen, after Solutré, the representative station of his third epoch of the Paleolithic period, but specifically he employs the name "feuille de laurier" (laurel leaf). In the classification of arrowpoints and spearheads (see p. 890) that form is assigned to Division I, Class A. Caches, as will be seen by the list (Appendix B, p. 970), are not exclusively of these implements; therefore the term cache implements is not sufficiently definite and should not be employed. Caches have been found of the large chipped flints, "spades" or "agricultural implements," arrowpoints and spearheads of different types, grooved axes, polished-stone hatchets, scrapers, and other implements.

Implements similar in material and identical in form with arrowpoints and spearheads have been found throughout the western and southwestern United States, but which, from their large size, could hardly have served for arrows or spears. An implement one to three inches long we recognize as an arrowpoint, one four to six inches long as a spearhead; but what shall we say as to one a foot or fifteen inches long? The U. S. National Museum possesses many of these specimens. They can not be ignored, and so have been assembled and reported in Appendix C (p. 982).

V. MATERIAL OF ARROWPOINTS AND SPEARHEADS.

Composition and structure—No practical difference between the flint of Europe and that of the United States—Microscopic examinations.

It has been shown that flint was the favorite material in prehistoric times for the manufacture of arrowpoints and spearheads and, indeed, for all chipped-stone implements, and was used by prehistoric man wherever obtainable. Flint, as is well known, is a variety of quartz; the principal difference so far as concerns the chemical constituents arising from the impurities. Quartz, also much used in prehistoric times in the manufacture of arrowpoints, is pure silica. It is $SiO_2 =$ silicon 46.67, oxygen 53.33. Its hardness is 7 in the scale of 10, and specific gravity 2.6 to 2.7. James D. Dana[1] divides quartz into two varieties, vitreous and cryptocrystalline. He divides the latter into the chalcedonic and jaspery varieties. The vitreous is distinguished by its glassy fracture, and the chalcedonic has a subvitreous or waxy luster and is translucent. These owe their peculiarities either to crystallization, mode of fabrication, or impurities. The common impurities of quartz, Dana says, are oxides of iron, clay, chlorite, or other minerals which produce opacity.

Of the first variety, the rock crystal is the representative. It is pure pellucid quartz. But such varieties as rose quartz, smoky quartz, false topaz, and amethyst are produced in one or more of the ways

[1] Manual of Geology, 1876, p. 52. Manual of Mineralogy and Lithology, 1886, p. 234.

mentioned. The chalcedonic variety includes the finer and more beautiful chalcedony, agate, carnelian, onyx, etc., as well as the grosser and baser variety to which belong flint, hornstone, chert, etc. The jaspery variety contains aluminous matter, and its color, yellow or red, is due to iron oxides. The bloodstone and basanite (lydian stone) belong to this.

Flint, free from impurities, has the same chemical composition as quartz, silicon combined with oxygen—silica.

Differences may arise in crystallization. Flint is of cryptocrystalline structure. Its color may be gray, shading through yellow, green, blue, and smoky black, or with tints of red, yellow, and brown, into chalcedony. Its fracture is conchoidal, not splintery, internal surface dull, scarcely ever glistening. Alone it is infusible before the blowpipe, but loses its color and becomes opaque. It is homogenous, has no cleavage, splits in any direction, therefore is easy to chip, yet is hard and tough and makes a keen cutting edge which does not crumble. It was the material best suited to the cutting implements of the prehistoric man and was preferred by him accordingly.

It is deemed useless to make analyses, because the only differences would be the number and amount of impurities, and these might differ with every locality if not with every specimen.

Rees's Encyclopedia[1] gives analyses of particular specimens as follows:

Constituents.	Klaproth.	Vaquelin.	Weigleb.
Silica	98.00	97.00	80.00
Lime	0.50	....	2.00
Alumina	0.25	1.00	18.00
Oxide of iron	0.25		....
Loss	1.00	2.00	....
Total	100	100	100

These are ancient analyses and are only given as samples. Their correctness is not verified.[2]

It has been stated many times by archæologic students and teachers that there was no true flint in the United States. But this is due to a difference of definition rather than of material. The flint of Europe, declared to be true flint, is represented as a concretionary deposit of

[1] Article "Flint."

[2] The attention of the student of this and related subjects is directed to some of the standard works: Nillson, "The Stone Age," 1843-1867; Stevens, "Flint Chips," 1870; Evans, "Ancient Stone Implements of Great Britain," 1872, 1899; S. J. Mackie, "Geologist," 1861, IV, pp. 26-29; T. McKenny Hughes, Proceedings Soc. Antiq., London, 2d ser., IV, p. 94; Geological and Natural History Repertory, II, May 1, 1868, No. 31, p. 126; S. J. Mackie, idem., III, p. 205, T. Baines, idem., pp. 258-262; T. McKenny Hughes, British Association, 1872, p. 189; Henry Christy, Trans. Ethnol. Soc., new ser., III, 1865, p. 362; Reliquiæ Aquitanicæ, Pt. 1, pp. 202-205.

silica, of cryptocrystalline structure, made in a bed or layer of soft chalk in the form of nodules. But it is not necessary, in order to be flint, that it be in the form of nodules nor that they be deposited in chalk; for the flint of Europe has been found in hard limestone in both nodules and strata. That found in the Jura Alps is deposited in strata in hard limestone and not in chalk. That at Spiennes was deposited in the clay both in strata and nodules. That used in the Mentone caves, of which there were wagon loads, and that along the Riviera, is in nodules and in limestone. The flint mine at Mur-de-Barrez (Aveyron) (fig. 54), opened by MM. Cartailhac and Boule, and the mine at Meudon (Oise) (fig. 56), discovered by Cuvier in 1822, confirms this view. These and other deposits, representing widely separated districts in France and others throughout Europe, show a general condition of flint deposited in strata as well as in nodules, and in limestone and clay as well as in chalk. These peculiarities of formation are paralleled in many localities of the United States. The differences in the deposit, and consequently in the formation of flint, are shown in many places throughout Europe. Some of them have been described, and if it was necessary many other localities could be mentioned.

The same is true of flint in the United States, whether it be fine under the name of chalcedony, or coarse under the names of chert and hornstone. James D. Dana says:[1]

> Flint occurs in nodules in chalk: not unfrequently the nodules are in part chalcedonic. Hornstone differs from flint in being more brittle; it is often found in limestone. Chert is an impure hornstone. Limestones containing hornstone or chert are often called cherty limestones.

Flint Ridge, Ohio (Plate 13) is a locality noted for its ledge deposit of flint, while the flint disks from Ohio and Illinois (Plates 62, 63) show deposits to have been in nodules. Flint disks of the same general shape and of corresponding material have been found in several of the western States. A cache at Beardstown, Cass County, Illinois, contained 1,500 implements, arranged in horizontal layers, separated by thin strata of clay. Another deposit, of 3,500 specimens, was found in Fredericksville, Schuyler County, Illinois. The largest of such nodules in the U. S. National Museum, from a deposit in Union County, Illinois, is of ovoid form and measures 7¾ inches in length by 6½ inches in width.

The following excerpts from the report on the Pentamerous limestone of the Clinton group, by Prof. James Hall,[2] shows that flint exists both in strata and in nodules in the indicated horizon and locality:

> On the Genesee River this rock outcrops on either side. In many places in Wayne and Monroe counties it contains nodules of hornstone which sometimes assume the form of chalcedony. This matter increases so much in Orleans and Niagara counties that it forms thin layers alternating with the limestone. Associated with this chert are found silicified fragments of shells and crinoidal joints. South of Modena thin,

[1] Manual of Mineralogy and Lithology, 1886, p. 237.

[2] Geology of the Fourth District of New York, Pt. IV, 1843.

irregular layers of impure limestone with much hornstone. Same at Lockport, eastward (p. 63).

* * * * * * *

The first mineral is hornstone of the Pentamerous mass. This often passes into translucent varieties and forms little cavities lined with chalcedony (p. 67).

* * * * * * *

Thick-bedded dark or bluish-gray limestone with irregular cavities and often silicous concretions of hornstone. This is persistent over a large extent of country (p. 87).

* * * * * * *

Corniferous limestone. This rock is distinguished from the limestone below by the presence of hornstone in layers or nodules, etc. In Seneca County it is in regular courses from 6 to 18 inches thick, usually separated by layers of hornstone and sometimes embracing flattened nodules of the same, which have a surface as if from the crystallization of some mineral in the space between the two rocks.

* * * * * * *

In other localities these layers of hornstone increase in number and thickness almost to the exclusion of calcareous matter, which from weathering leaves the hornstone in jagged and irregular projecting points, and is locally called "chawed rock" (p. 162).

* * * * * * *

On the west side of the Genesee its cherty characters are better developed than elsewhere. Between Caledonia and Leroy there are hundreds of acres literally paved with hornstone in small angular fragments or larger masses united by carbonate of lime (p. 158).

* * * * * * *

The hornstone sometimes passes into chalcedony (p. 168).

Dana[1] says:

The hornstone of the Corniferous limestone is full of microscopic plants, or protophytes, from 1–500th to 1–5000th of an inch in diameter; and with them are sponge-spicules and teeth of mollusks.

* * * * * * *

The Cretaceous limestones in Texas * * * contain hornstone distributed through them, like the flint through the Chalk of England.

The impurities in flint marked by different colors may be peculiar to certain localities. By them the products of different mines have been traced through their sometimes long voyages in the hands of their prehistoric owners. The color of the flint from Grand Pressigny, near Tours, France, is that of beeswax; that from Meudon, near Paris, is nearly white; that from Spiennes, Belgium, is light-gray; that from Italy, especially from the southern part, has the lustrous brown of jasper and chalcedony. Of that from England, Grimes Graves is light-gray, similar in appearance to that of Spiennes; Brandon is quite black; Cissbury is dark-brown, almost black, weathering out into chalky whiteness.

Of the flint from the United States, that from Illinois is light-gray, weathering out to chalky-white, while that from Flint Ridge (which does not weather white) passes through the entire range of color from the waxy luster of brilliant chalcedony to the dull opacity of degraded chert.

[1] Manual of Geology, 1876, pp. 257 and 455.

The cryptocrystalline variety of quartz comprises a considerable list of minerals: Opal, agate, chalcedony, flint, chert, hornstone, beginning with the finest and purest and graduating down according to the relative impurities and differences in mode of combination. Changes in color run through the entire spectrum, and are due principally to the presence of metallic oxides. Iron is chargeable with most of them, but green is credited by Dana to nickel, and purple to manganese. If there were no impurities or foreign matter in it, the flint would be nearly clear-white.

MICROSCOPIC EXAMINATION OF FLINT.

The author has shown that the rock called flint is found alike in America and Europe; that it occurs in the two countries in both nodules and strata, and in both is found in limestone as well as in chalk. He proposes to continue the examination by comparing the structure of the rock in the two countries, and to that end has caused to be made thin sections of the flint from several of the mines and quarries mentioned, and these subjected to microscopic inspection and description by Dr. G. P. Merrill, head curator of the department of geology in the U. S. National Museum. These sections have been enlarged by the aid of the microscope, and are shown in the photographic plates (16 to 22) duly identified, with the name, number, and locality. Accompanying them are Dr. Merrill's descriptions, while Plates 23 and 24 show the original specimens from which the thin sections were taken, appropriately marked for identification and comparison.

We have now shown that the chemical constituents, the kind of deposit, nodules and strata, in limestone and chalk, general appearance, mode of mining and of use were practically the same during prehistoric times in America and in Europe. If the microscopic examinations show the rock from both countries to be of the same cryptocrystalline structure, the principal, if not the sole difference being in the degree of purity (or, rather, impurity), the author ventures to suggest that there is nothing gained by making a distinction of names between the flint of Europe and that of the United States, and that the distinction, if made, is so finely drawn as to be impracticable for use by the archæologists who deal with the material.

These microscopic sections have been presented so that their structure can be compared and their similarity demonstrated:

Plate 16, fig. 1, represents a specimen of flint from Brandon,[1] fig. 2 is from Grimes Graves, and fig. 3 from Dorchester, all from England.

Plate 17, fig. 1, is from Havelse, Denmark; fig. 2 is from Mouy, Meudon, France, while fig. 3 is from Spiennes, Belgium.

Plate 18, fig. 1, is from Grand Pressigny, France; figs. 2 and 3 are from Flint Ridge, Licking County, Ohio.

[1] Specimen fig. 1, on Plate 16 (flint from Brandon), is modern. All others are prehistoric, at least ancient, specimens.

EXPLANATION OF PLATE 16.

MICROSCOPIC THIN SECTIONS OF FLINT.

Fig. 1. FLINT.[1] An extremely fine-grained aggregate of chalcedonic particles. The structure is cryptocrystalline, so fine that the optical properties of the individual particles can not be determined. Throughout this cryptocrystalline base or groundmass are scattered numerous small colorless polarizing particles and occasional segregation areas of the chalcedonic material in a coarser or more granular condition. Beyond this, the microscope shows only minute amorphous yellowish and black particles which are presumably ferruginous and carbonaceous matter. Organic remains (sponge, spicula, and diatoms) were not specially sought for, but we find an occasional form in outline suggestive of a chalcedonic cast of the shell of a foraminifera. Section nearly colorless.

(Cat. No. 139130, U.S.N.M. Brandon, England. Plate 24, fig. 7.)

Fig. 2. FLINT. Substantially the same as Cat. No. 139130, with the exception that the section shows a greater number of the spherical areas of radiating particles of chalcedonic quartz. No forms observed that can be identified with certainty as foraminifera.

(Cat. No. 139112, U.S.N.M. Grimes Graves, England. Plate 23, fig. 1.)

Fig. 3. FLINT. For all the microscope discloses, this might be a section from specimen Cat. No. 139112, from Grimes Graves. This specimen was found by the author in a prehistoric workshop at Dorchester, Dorsetshire, England, and came from one of the neighboring flint mines.

(Cat. No. 99866, U.S.N.M. Dorchester, England. Plate 23, fig. 7.)

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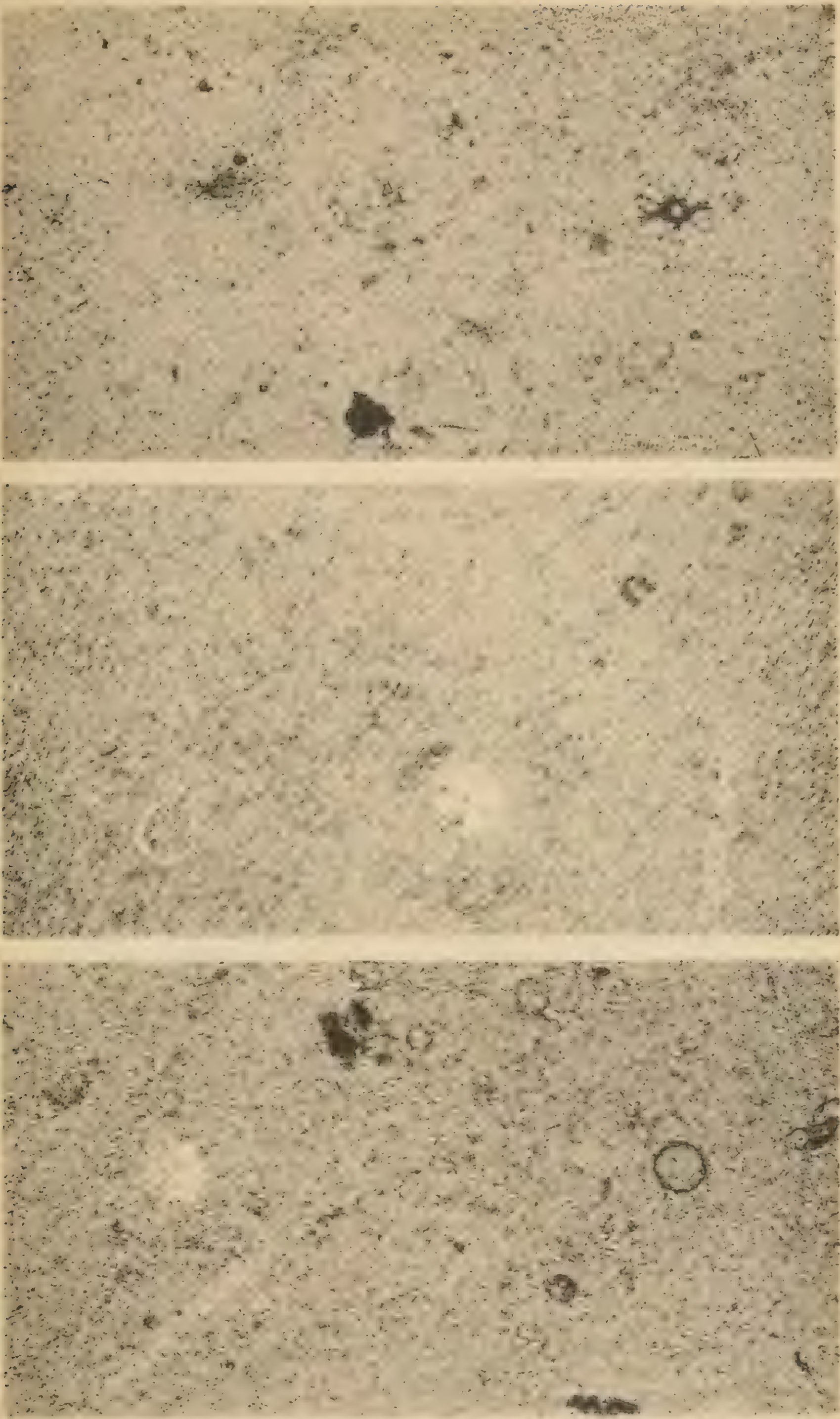
[1] Mineralogical descriptions by Dr. G. P. Merrill, U. S. National Museum.



MICROSCOPIC THIN SECTIONS OF FLINT.
England.

EXPLANATION OF PLATE 17.

Microscopic Thin Sections of Flint.

Fig. 1. Flint.[1] In every way essentially similar to Cat. No. 139130. The segregation areas show the chalcedonic particles more distinctly in the fan-shaped or radiating forms characteristic of the mineral.

(Cat. No. 101057, U.S.N.M. Havelse, Denmark. Plate 24, fig. 9.)

Fig. 2. Flint. Slightly less uniform in structure than Cat. No. 99866, but otherwise essentially the same. These gregations of coarser particles are in the form of irregular strings and spots, rather than in oval areas as in the other specimens.

(Cat. No. 100138, U.S.N.M. Camp Barbet, Mouy, Meudon, France. Plate 23, figs. 9, 10.)

Fig. 3. Scrapers. Groundmass of this rock is essentially similar to that of specimens Cat. Nos. 139130, 101057, from Brandon, England, and Havelse, Denmark, respectively. An occasional grain of quartz may be distinguishable, but the only difference of note is a large amount of black amorphous impurities with which the rock is injected. The chalcedonic forms noted in Cat. No. 139130 as suggestive of foraminifera are more abundant and so plainly defined as to leave no doubt regarding their nature.

(Cat. No. 100259, U.S.N.M. Spiennes, Belgium. Plate 23, fig. 3.)

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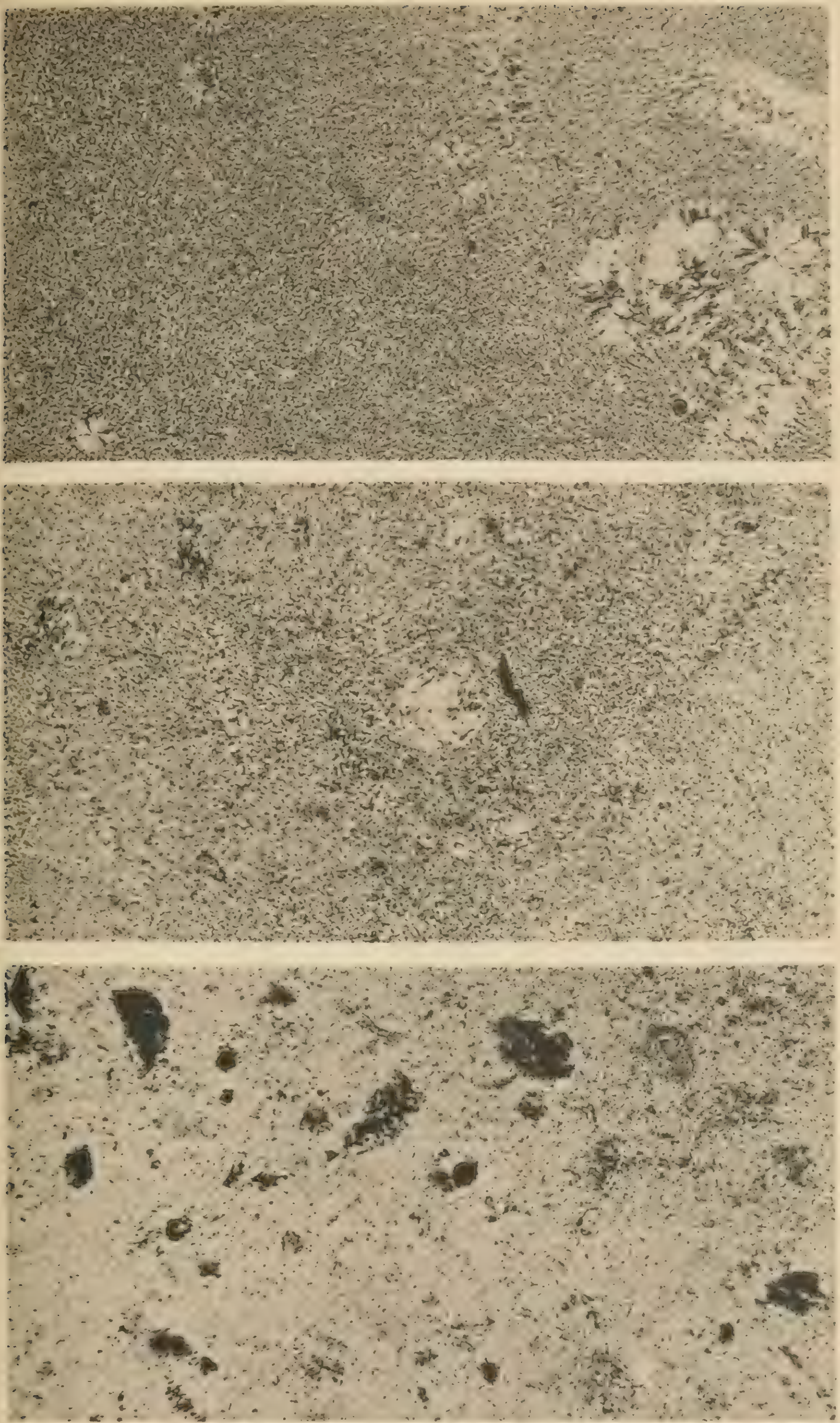
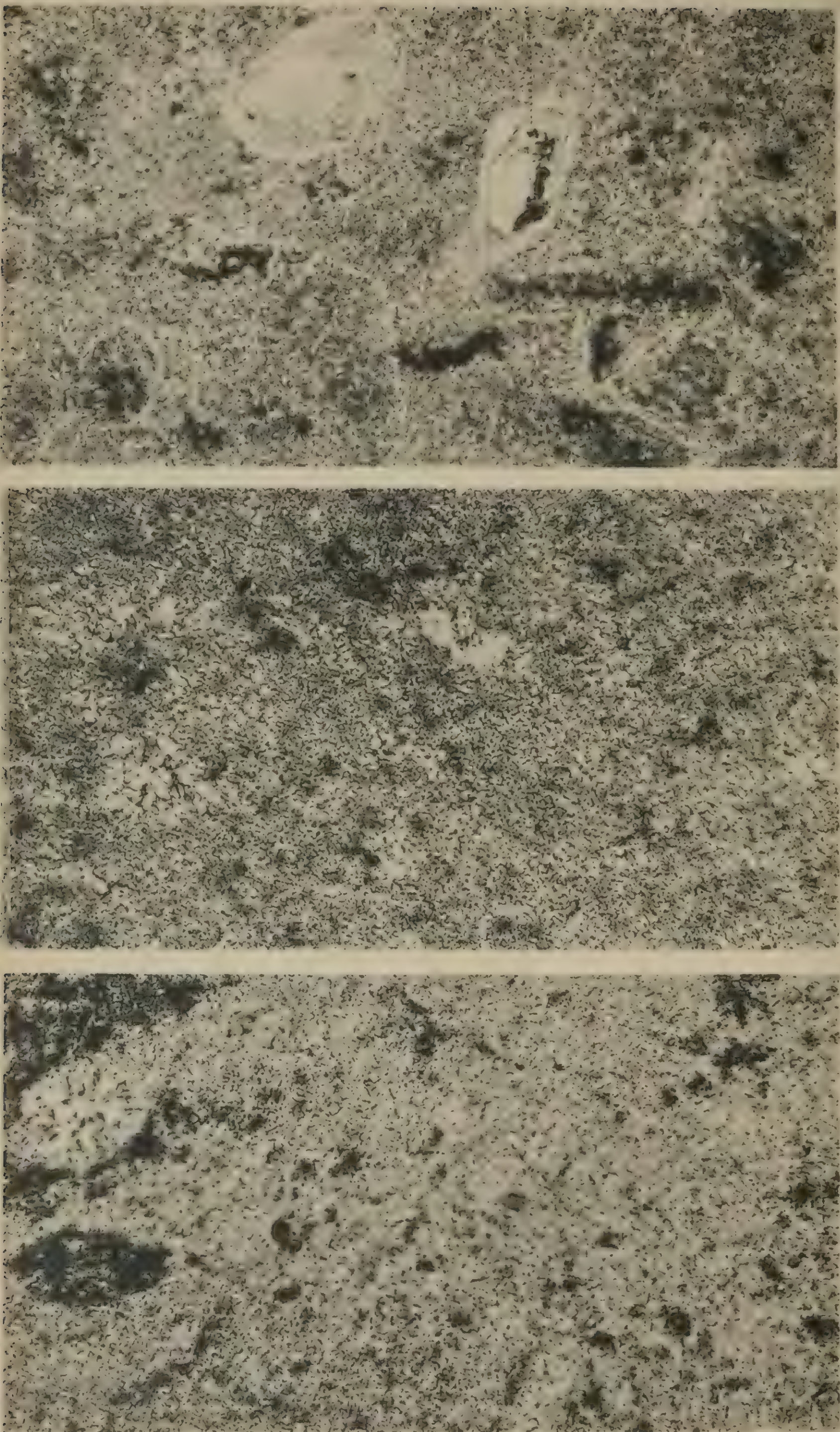
[1] Mineralogical descriptions by Dr. G. P. Merrill, U. S. National Museum.



MICROSCOPIC THIN SECTIONS OF FLINT.
Denmark, France, and Belgium.



MICROSCOPIC THIN SECTIONS OF FLINT.
France and United States.

EXPLANATION OF PLATE 18.

MICROSCOPIC THIN SECTIONS OF FLINT.

Fig. 1. FLINT.[1] This specimen differs from Cat. No. 100259, or Plate 17, fig. 3, first, in coarseness of texture, and second, in showing an abundant sprinkling of crystalline granules of quartz. The slide is made up of irregularly oval areas of chalcedonic particles, sometimes rendered almost opaque by ferruginous and carbonaceous impurities, the interstices being occupied by the material differing only in degree of purity, the carbonaceous matter being confined mainly to the oval areas, the appearance being as though the interstitial deposit was made subsequently and under more favorable conditions (as regards purity).

(Cat. No. 99908, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Plate 24, fig. 8.)

Fig. 2. PINK FLINT. This, like those from Europe, is mainly a compact cryptocrystalline mass of chalcedonic silica, with segregation areas of the same material showing the characteristic spherulitic and fan-shaped arrangement of the particles. In a few instances the slide shows small areas of granular crystalline quartz. The rock is injected with iron oxide sufficient to give it a reddish or yellowish tinge, and the foraminifera remains noted in the European specimens are quite lacking.

(Cat. No. 98344, U.S.N.M. Flint Ridge, Licking County, Ohio. Plate 24, fig. 6.)

Fig. 3. BLACK FLINT. This slide differs from the last (Cat. No. 98344) mainly in being of finer texture and in carrying an abundance of muddy and opaque carbonaceous matter which is not distributed uniformly through the mass of the rock, but occurs rather in blotches and streaks. The slide shows further numerous irregular sharply angular areas with curvilinear outlines so filled with impurities as to be of a dirty-brown color, and which are wholly without action on polarized light, indicative of silica in an opalescent form. There are numerous elongated cylindrical bodies which are without action on polarized light, which are suggestive of something of an organic nature.

(Cat. No. 98344a, U.S.N.M. Flint Ridge, Licking County, Ohio. Plate 24, fig. 4.)

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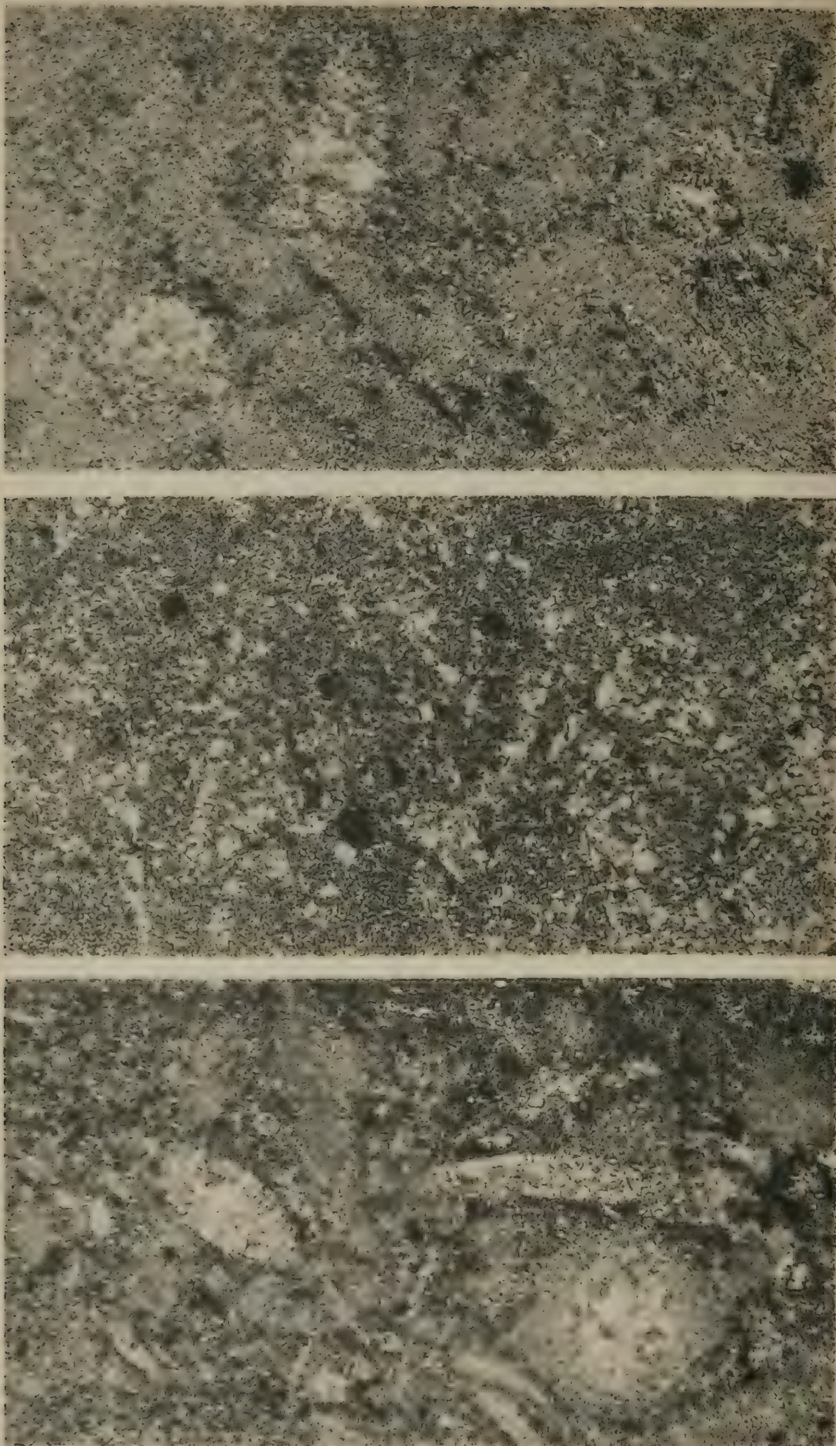
[1] Mineralogical descriptions by Dr. G. P. Merrill, U. S. National Museum.



MICROSCOPIC THIN SECTIONS OF FLINT.

United States.

EXPLANATION OF PLATE 19.

MICROSCOPIC THIN SECTIONS OF FLINT.

Fig. 1. WHITE FLINT.[1] This section shows a ground of chalcedonic particles interspersed with numerous irregular areas filled with an outer zone of chalcedonic material and interstitially with calcite. The structure may be compared with amygdaloids of volcanic rocks. It shows a single shred of ferruginous mica.

(Cat. No 59726, U.S.N.M. Pike County, Illinois. Plate 23 fig. 5.)

Fig. 2. BLACK FLINT DISK. This slide differs from anything we have had, in that, while it is composed mainly of chalcedonic silica, it has, under the microscope, an almost granular aspect, and carries, moreover, a large amount of calcite. There is very little true quartz, the larger granules and cryptocrystalline portions showing the optical properties of chalcedony. The most marked characteristics of the rock is the abundance of calcite as above noted, and which occurs in the form of aggregate and minute irregular particles as fine as dust, distributed throughout the entire mass of the rock, and also in well-defined rhomboidal crystals. Nothing of organic forms is recognizable. Qualitative test shows the presence of lime, alumina, and iron, as well as silica.

(Cat. No. 15350, U.S.N.M. Cass County, Illinois. Dr. J. F. Snyder. Plate 24, fig. 5.)

Fig. 3. CHERT. A dense brownish aggregate of chalcedony and calcite, with many elongated rounded and oval areas now occupied by calcite crystals, but which are suggestive in outline of Fusulina.

(Cat. No. 26582, U.S.N.M. Kansas.)

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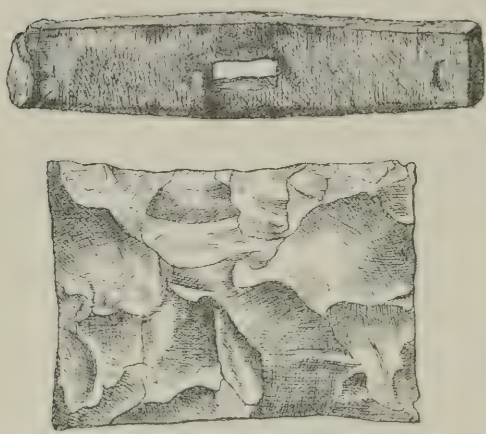
[1] Mineralogical descriptions by Dr. G. P. Merrill, U. S. National Museum.

At the Paris Exposition of 1889 Dr. Capitan displayed a series of stone implements in all stages of progress and approaching completion, together with the tools used in their manufacture. The possible method of making stone implements was discussed at the tenth session of the International Congress of Prehistoric Archaeology of Paris in 1889. M. A. de Mortillet showed, with illustrations, the cracking and chipping of flint by the heat of the sun, exposure to the air, by fire, by percussion, and pressure. Dr. Capitan gave a practical demonstration of the methods employed. He used the hammer, with and without the intervention of a punch, by stroke, free hand, and on the anvil. The nucleus was the débris, while the flake was the desired product. The flake, larger or smaller, once obtained, was subjected to secondary chipping, by which it was made into the arrowpoint, spearhead, or knife, according to the intention of the maker and the possibilities of the material. This was done by percussion or striking with a hammer either with or without the intervention of a punch, while the object is held in the hand or on the knee; by pressure with a flaker, and (for other implements than arrow or spear heads) by hammering or pecking, and by grinding or polishing.[1]



Figs. 62, 63.
IRON FLAKING HAMMER AND A "STRIKE-A-LIGHT" MADE WITH IT.
Albania, Greece.
Collected by Mr. Arthur J. Evans. Jour. Anthrop. Inst., XVI, pl. 1, figs. 1-3. Natural size.

Sir John Evans interested the International Congress of Prehistoric Archæology, held in Norwich, England, in 1868, by making in its presence flint implements, both by pressure and percussion. At the meeting of the British Association in Aberdeen he showed specimens of the flint knapper's work obtained by his son, Mr. Arthur J. Evans, in the town of Joannina, in the province of Epirus, southern Albania. Mr. Arthur J. Evans had met the old workman in the streets engaged in making the strike-a-lights for market, and after seeing him work, getting samples of his wares and materials, being shown the limestone plateau from which he obtained the flint nodules, Mr. Evans purchased the entire outfit, flint, tools, and all, and they were exhibited before the association. Afterwards the paper was read before the Anthropolog-

[1] Report of International Congress, American Naturalist, XXV, November, 1891, p. 1032.

EXPLANATION OF PLATE 20.

MICROSCOPIC THIN SECTIONS OF FLINT AND OTHER ROCK.

Fig. 1. BLACK FLINT.[1] Essentially the same combination as Cat. No. 15350, from Illinois.

(W. X. Plates 19, fig. 2; 24, fig. 5.)

Fig. 2. ARGILLITE. Schistose aggregate of quartz particles and much undeterminable gray matter which might readily pass for partially metamorphosed argillitic material of a sedimantary rock.

(Cat. No. 139010, U.S.N.M. District of Columbia, vicinity of Chain Bridge. Plate 24, fig. 3.)

Fig. 3. ARGILLITE? The groundmass of this rock is made up of a gray material showing between a crossed nicol. No distinct crystalline forms, but breaking up as the stages revolve into irregular areas polarizing faintly in light and dark colors. The properties are too obscure to be of determinative value. Throughout this groundmass are scattered numerous irregular areas of quartz, of feldspars which have crystallized *in situ*, and small shreds of greenish mica. I am unable to satisfy myself regarding the petrographic nature of the rock, and can only suggest that it may be an argillaceous sedimentary which has undergone a certain amount of dynamic metamorphism.

(Cat. No. 99269, U.S.N.M. Trenton, New Jersey.)

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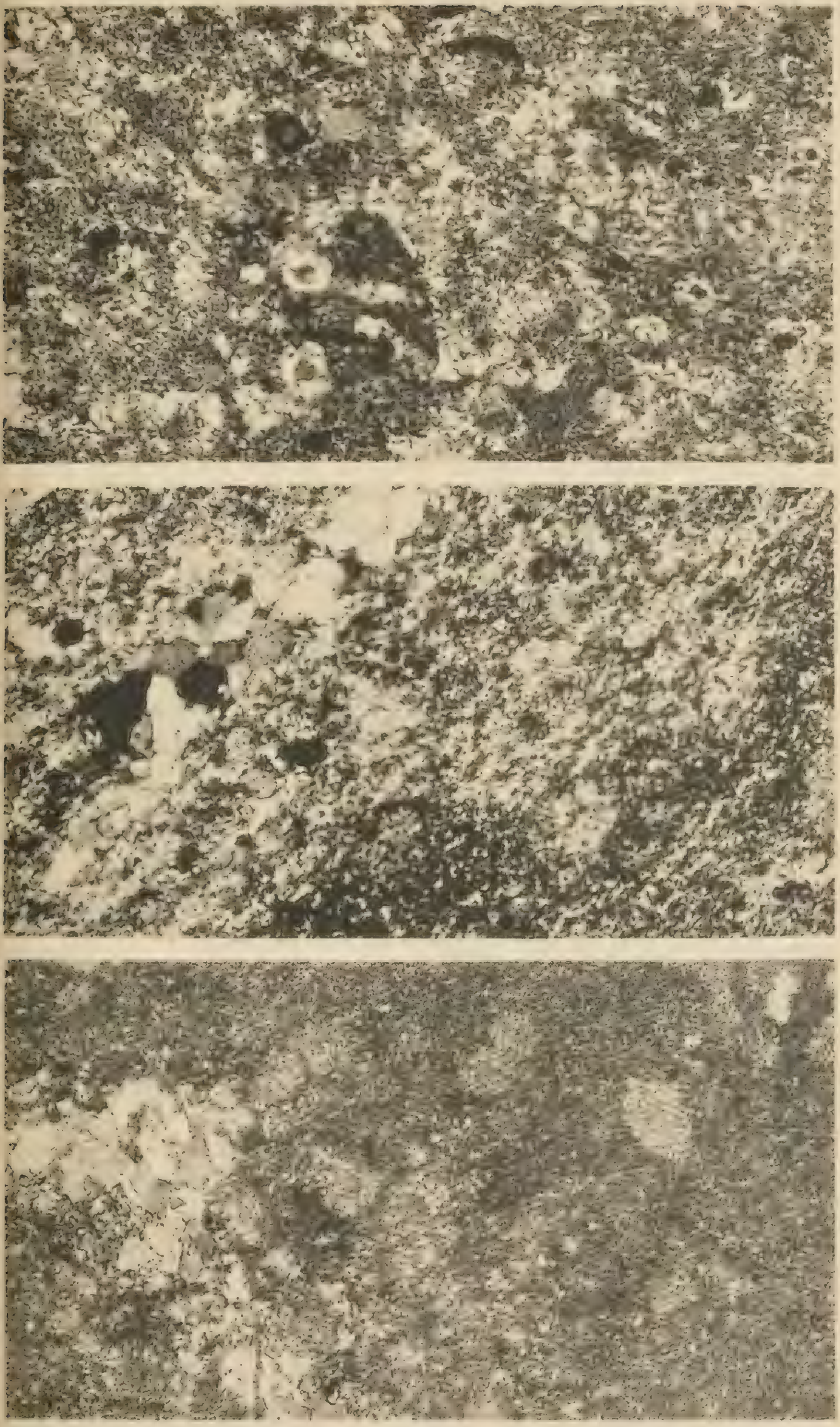
[1] Mineralogical descriptions by Dr. G. P. Merrill, U. S. National Museum.



MICROSCOPIC THIN SECTIONS OF FLINT AND OTHER ROCKS.
United States.

EXPLANATION OF PLATE 21.

Microscopic Thin Sections of Flint and Other Rocks.

Fig. 1. Oolitic chert. This is made up of rounded concretionary masses of chalcedonic silica held together by an interstitial cement, which is largely quartz in a finely granular condition, but in part chalcedony. The oolitic forms are rendered very impure by inclosures of dust-like particles and black, opaque particles of iron ore, while the interstitial material is comparatively colorless.

(Cape May, New Jersey.)

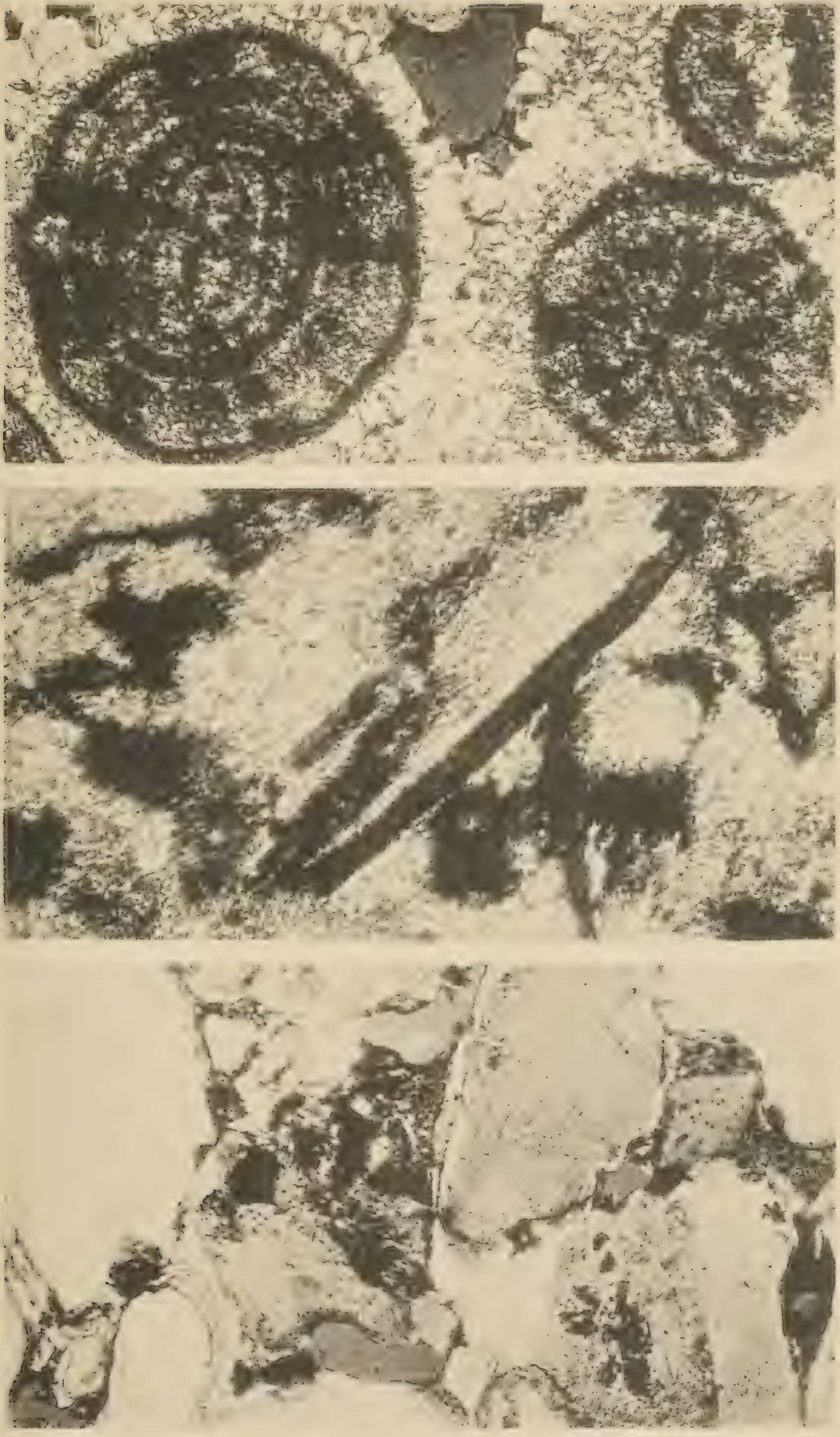
Fig. 2. Gray chert. This section shows a mass of irregular rounded oval, greatly elongated and sometimes angular, areas with curvilinear outlines, of a dirty-brownish color, and which are sometimes wholly without action on polarized light and sometimes show the cryptocrystalline structure charteristic of chalcedony. These areas are interspersed with silica in the form of colorless chalcedony and granular quartz.

(Cat. No. 71607, U.S.N.M. Clark or Lewis County; Missouri. Plate 23, fig. 6.)

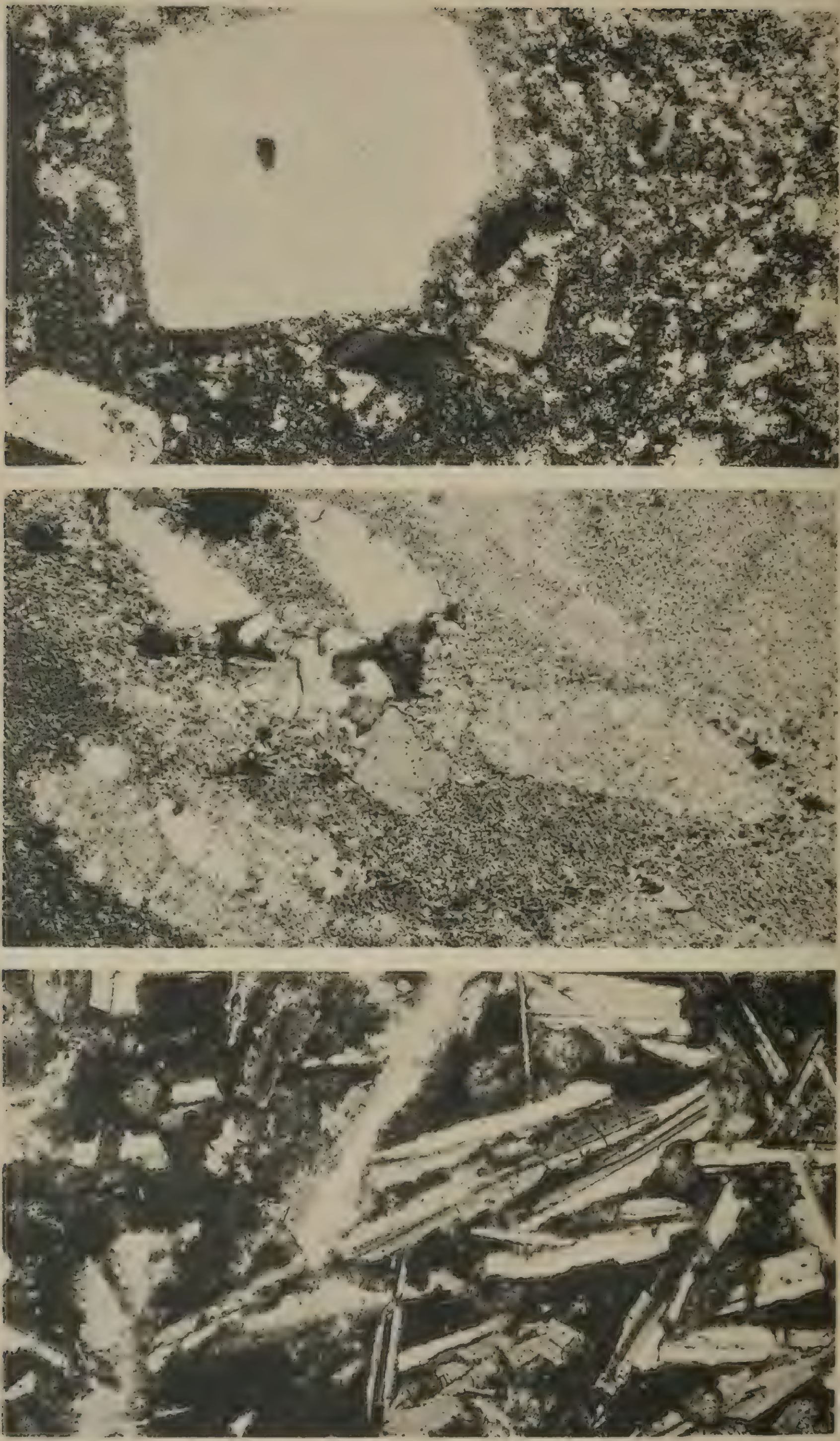
Fig. 3. Quartzite. An indurated siliceous sandstone, consisting of well-rounded grains of colorless quartz bound into a compact mass by a secondary disposition of interstitial silica. This secondary silica has so oriented itself with regard to the original sand grains as to convert the rock into an aggregate of imperfectly outlined quartz crystals, of which the original sand grains form the nuclei.

(Cat. No. 26268, U.S.N.M. Potsdam, New York.)

Mineralogical descriptions by Dr. G. P. Merrill, U. S. National Museum.



MICROSCOPIC THIN SECTIONS OF FLINT AND OTHER ROCKS.
United States.



MICROSCOPIC THIN SECTIONS OF ROCKS, USED FOR ABORIGINAL IMPLEMENTS.
United States.

EXPLANATION OF PLATE 22.

MICROSCOPIC THIN SECTIONS OF ROCKS, USED FOR ABORIGINAL IMPLEMENTS.

Fig. 1. QUARTZ PORPHYRY. A dense felsite groundmass, bearing abundant quartzes in both rounded and angular forms, often deeply corroded and more rarely well-defined phenocrysts. The structure is common to the quartz porphyries, but shows no appreciable flow structure. In a single instance is noted a brilliantly polarizing aggregate of the manganese epidote, piedmontite.
(Cat. No. 27861, U.S.N.M. Norfolk, Connecticut.)

Fig. 2. ARGILLITE ?. Schistose, semi-metamorphic rock, the optical properties of which are too obscure for satisfactory determination.
((C. B.) Chain Bridge, Virginia, or District of Columbia.)

Fig. 3. DIABASE This shows a wholly crystalline aggregate of elongated feldspar and augite with the characteristic ophitic structure of diabase.
(Cat. No. 16708, U.S.N.M. Spartanburg, South Carolina.)

Mineralogical descriptions by Prof. G. P. Merrill, U. S. National Museum.

SPECIMENS OF ROCK FROM WHICH THIN SECTIONS WERE MADE.

EXPLANATION OF PLATE 23.

1		2		3
4	5	6	7 8	9
10		11		12
13		14		15

Fig. 1. Rude Flint Implement.
(Cat. No. 139112, U.S.N.M. Prehistoric mines, Grimes Graves, Brandon, Suffolk, England. Edward Lovett.)

Fig. 2. Flint Flake.
(Cat. No. 139078, U.S.N.M. Prehistoric mines, Cissbury, Sussex, England. Edward Lovett.)

Fig. 3. Worked Flake, Scraper.
(Cat. No. 100259, U.S.N.M. Prehistoric mine, Spiennes, Belgium. Thomas Wilson.)

Fig. 4. Rude Flint Implement.
(Cat. No. 98346, U.S.N.M. Prehistoric mine or quarry, Flint Ridge, Licking County, Ohio. Gerard Fowke.)

Fig. 5. Leaf-shaped Implement of Flint.
(Cat. No. 59726, U.S.N.M. Mound, Pike County, Illinois. Rev. T. D. Weems.)

Fig. 6. Leaf-shaped Implement of Flint.
(Cat. No. 71607, U.S.N.M. Clark County, Missouri. P. W. Norris.)

Fig. 7. Worked Flint Flake (neolithic).
(Cat. No. 99866, U.S.N.M. Dorchester, England. Thomas Wilson.)

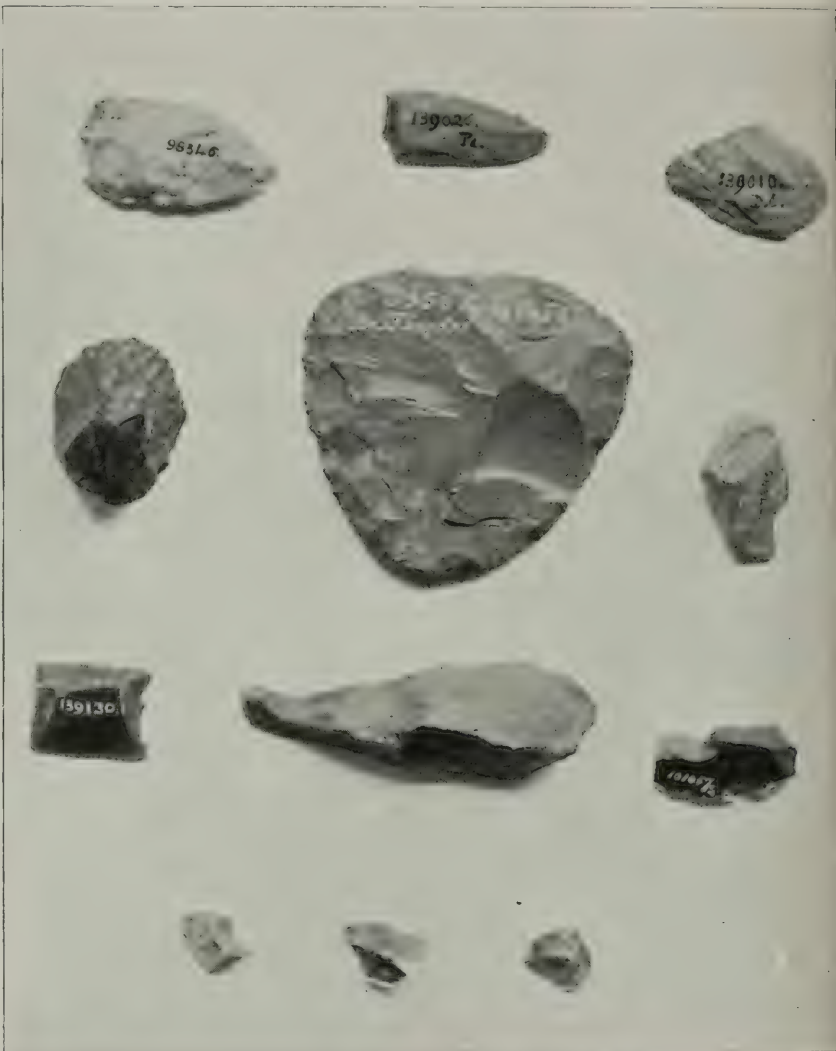
Fig. 8. Fragment of Small Flint Implement.
(Cat. No. 101058, U.S.N.M. Kitchen-Midden, Havelse, near Copenhagen, Denmark. Thomas Wilson.)

Figs. 9, 10. Worked Flint Flakes.
(Cat. No. 100138, U.S.N.M. Camp Barbet, Mouy, near Paris (Seine-et-Oise), France, Thomas Wilson.)

Fig. 11. Flint Nucleus.
(Cat. No. 100139, U.S.N.M. Camp Barbet, France. Thomas Wilson.)

Figs. 12, 13, 15. Flint Scrapers.
(Cat. Nos. 100103, 100097, 100110, U.S.N.M. Camp Barbet, France. Thomas Wilson.)

Fig. 14. Flint Hammerstone.
(Cat. No. 100086, U.S.N.M. Camp Barbet, France. Thomas Wilson.)



SPECIMENS OF ROCK FROM WHICH THIN SECTIONS WERE MADE.

EXPLANATION OF PLATE 24.

Fig. 1. Rude Flint Implement.

(Cat. No. 98346, U.S.N.M. Prehistoric mine or quarry, Flint Ridge, Licking County, Ohio. Gerard Fowke.)

Fig 2. Leaf-shaped Implement of Quartz-porphyry.

(Cat. No. 139026, U.S.N.M. Muncy Valley, west branch of Susquehanna River, Pennsylvania. J. M. M. Gernerd.)

Fig. 3. Leaf-shaped Implement of Argillite (?).

(Cat. No. 139010, U.S.N.M. District of Columbia, in vicinity of Chain Bridge. Ernest Shoemaker.)

Fig. 4. Flint Core.

(Cat. No. 98344*a*, U.S.N.M. Prehistoric mine or quarry, Flint Ridge, Licking County, Ohio. Gerard Fowke.)

Fig. 5. Chipped Flint Disk.

(Cat. No. 15350, U.S.N.M. Cass County, Illinois. Dr. J. F. Snyder.)

Fig. 6. Flint Core.

(Cat. No. 98344, U.S.N.M. Prehistoric mine or quarry, Flint Ridge, Licking County, Ohio. Gerard Fowke.)

Fig. 7. Modern Gunflint.

(Cat. No. 139130, U.S.N.M. Brandon, England. Edward Lovett.)

Fig. 8. Large Worked Flint Flake.

(Cat. No. 99908, U.S.N.M. Grand Pressigny (Indre-et-Loire), France. Thomas Wilson.)

Fig. 9. Fragment of Flint Flake.

(Cat. No. 101057, U.S.N.M. Havelse, Denmark. Thomas Wilson.)

Figs. 10–12. Fragments of small Flint Implements.

(Cat. No. 101058, U.S.N.M. Kitchen-Midden, Havelse, near Copenhagen, Denmark. Thomas Wilson.)

ical Institute, London, and published, and the objects were figured.[1] The author has taken the liberty of using the figure of the hammer and one of the flint strike-a-lights made with it (figs. 62, 63).

Mr. Evans describes the hammer as—

A small elongated section of square, rudely beaten iron bar, about 2½ inches long by one-third of an inch broad, fitted by means of a hole in the middle to what seemed a very slender handle. Using this instrument with marvelous dexterity, he chipped out the flake into the required shape by short, swift side strokes of the hammer (p. 65).

Fig. 64.

FLINT CORE WITH ITS FLAKES IN PLACE AS STRUCK.

Evans Ancient Stone Implements, p. 18, fig. 2.

Reference is made to Plates 8–10, where the modern English flint knapper's hammer is shown in all its varieties.

Nillson[2] gives his personal experience in the art of flint chipping.

The methods of treating the nodule or block of flint by the use of the hammer (1) in preparing the nucleus, and (2) in striking off the flakes, have been shown in Plates 8–10 and figs. 62–65, and described in the making of gunflints at Brandon mine and the nuclei at Grand Pressigny (Plate 7, fig. 1). By these descriptions, combined with the figure of a nucleus or core with the flakes once struck off and then replaced, the operation will be understood and the descriptions need not be repeated. Fig. 64 shows one of these nodules from the Brandon quarry which has been chipped into flakes, ready to be cut up into gunflints or arrow points. These flakes, having been struck off, are, in the engraving, replaced so as to show the process. Fig. 65 is a section of a flint nucleus, with several flakes in process of being struck off.

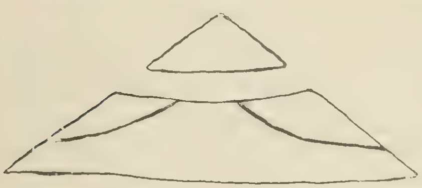


Fig. 65.

SECTION OF FLINT NUCLEUS, SHOWING HOW FLAKES ARE STRUCK OFF.

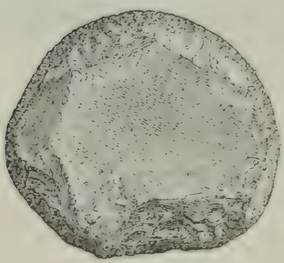
Plate 25 shows the cores, flakes, and the finished arrowheads of obsidian as they are found in America. This material is of volcanic origin and it is usually attributed to the Rocky Mountain

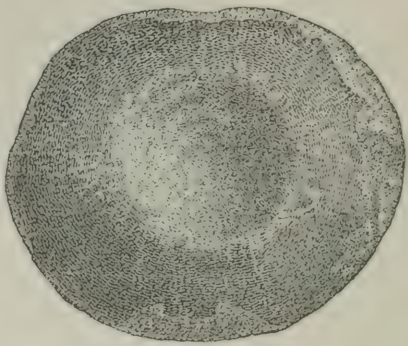
[1] Proceedings, XVI, p. 65, pl. 1.

[2] The Stone Age of Scandinavia, p. 7,

ranges, though by commerce specimens have traveled great distances. Prof. W. K. Moorehead found about a thousand large and well-wrought obsidian spearheads and arrowpoints in the great mound on Hopewell farm,[1] Ross County, Ohio, which he has cited in The Antiquarian.[2]

The specimens shown in Plate 25, figs. 1 to 4, are cores of great size and beauty. The flakes have never been replaced as in the case of the Brandon core just shown, but one can easily see that the mode of manufacture was the same. They were struck off by a blow, and the conchoid of percussion is always to be seen on both the flake and the core. The arrowpoints and spearheads, leaf-shaped and stemmed, are samples of those of obsidian from the Pacific coast. Their chipping shows delicate workmanship.





HAMMERSTONES.

Fig. 66.—White jaspery flint.
Ohio.
Cat. No. 17311, U.S.N.M. ½ natural size.

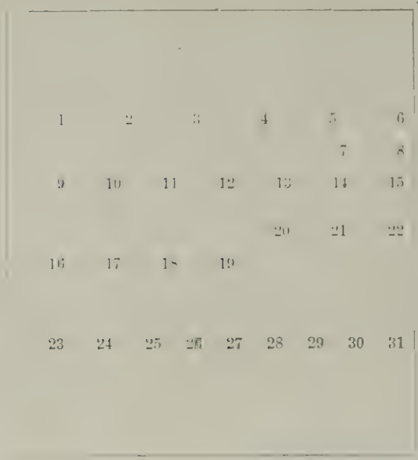
Fig. 67.—Quartzite pitted.
New York.
Cat. No. 6602, U S.N.M. ½ natural size.

The principal tool used by prehistoric man was the stone hammer (fig. 66–7). Thousands of these have been found, and their distribution extends over nearly the entire prehistoric world. They were hard, so as to stand the blows without breaking. Any sort of stone which possessed the requisite condition of hardness and was of suitable size would serve the purpose. Bowlders of quartzite were not infrequently used and the periphery or prominent ends or corners frequently show the battered or pecked surface, the evidence of use. Many of these quartzite bowlders have a cup marking on the one or the other of the flattened sides, the precise purposes of which have never been satisfactorily determined. It has been contended by some that they were indentations for the thumb and fingers, to assist in holding the hammer in the hand, but this theory has not been accepted.

[1] Clark's Work; Squier and Davis, Smithsonian Contributions to Knowledge, No. 1, p. 26, pl. x.

[2] October, 1897, p. 255, fig. xlvii; November, 1897, p. 291, figs. l, liv, lv.

EXPLANATION OF PLATE 25.



Figs. 1–3. Obsidian Cores.
(Cat. Nos. 98772, 98771, 98768, U.S.N.M. Cholula, Mexico. W. W. Blake.)

Fig. 4. Obsidian Core.
(Cat. No. 1049, U.S.N.M. Mound near Vera Cruz, Mexico. Lieutenant Van Wyck, U. S. N.)

Figs. 5, 6. Obsidian Cores.
(Cat. Nos. 98776, 98769, U.S.N.M. Mexico. W. W. Blake.)

Figs. 7, 8. Small Flakes of Obsidian.
(Cat. No. 20025, U.S.N.M. Mounds near Cordova, Mexico. Dr. Hugo Finck.)

Fig. 9. Leaf-shaped Implement of Obsidian.
(Cat. No. 139397, U.S.N.M. Klamath Indian Reservation, Oregon. C. K. Smith.)

Fig. 10. Leaf-shaped Implement of Obsidian (broken).
(Cat. No. 9347, U.S.N.M. Cordova, Mexico. Dr. Hugo Finck.)

Fig. 11. Worked Flake of Obsidian (scraper?).
(Cat. No. 98765, U.S.N.M. Mexico. W. W. Blake.)

Figs. 12–15. Flakes of Obsidian.
(Cat. No. 9359, U.S.N.M. Cordova, Mexico. Dr. Hugo Finck.)

Fig. 16. Arrowpoint of Obsidian.
(Cat. No. 98777, U.S.N.M. Mexico. W. W. Blake.)

Fig. 17. Arrowpoint of Obsidian.
(Cat. No. 9355, U.S.N.M. Cordova, Mexico. Dr. Hugo Finck.)

Fig. 18. Arrowpoint of Obsidian.
(Cat. No. 98792, U.S.N.M. Tezcuco, Mexico. W. W. Blake.)

Figs. 19, 20. Arrowpoints of Obsidian.
(Cat. Nos. 9354, 9353, U.S.N.M. Cordova, Mexico. Dr. Hugo Finck.)

Fig. 21. Leaf-shaped Implement of Obsidian.
(Cat. No. 9352, U.S.N.M. Cordova, Mexico. Dr. Hugo Finck.)

Fig. 22. Arrowpoint of Obsidian.
(Cat. No. 139398, U.S.N.M. Klamath Indian Reservation, Oregon. C. K. Smith.)

Figs. 23, 24. Arrowpoints of Obsidian.
(Cat. Nos. 98781, 98786, U.S.N.M. Mexico. W. W. Blake.)

Figs. 25–27. Obsidian Arrowpoints.
(Cat. No. 149391, U.S.N.M. Buttes, 4 miles west of Upper Gallinas, New Mexico. Lieut. G. M. Wheeler.)

Fig. 28. Leaf-shaped Implement of Obsidian.
(Cat. No. 148127, U.S.N.M. "Equus beds" near Silver Lake, Oregon. Prof. E. D. Cope.)

Fig. 29. Worked Flake of Obsidian.
(Cat. No. 35176, U.S.N.M. Island of Crete. G. L. Feuardent.)

Fig. 30. Obsidian Core.
(Cat. No. 35169, U.S.N.M. Island of Crete. G. L. Feuardent.)

Fig. 31. Flint Core.
(Cat. No. 100953, U.S.N.M. Lund, Sweden. Thomas Wilson.)

OBSIDIAN CORES, FLAKES, AND FINISHED ARROWPOINTS.

Principally from North America.

The principal kind of hammer used, especially in Europe and at Flint Ridge in Ohio, and in all other places where there is a stratum of flint, is a rude and irregular piece of flint from the ledge. Its sharp corners and edges served better the purpose of a hammer, enabling the workmen to strike a more precise blow and with a smaller point of impact.

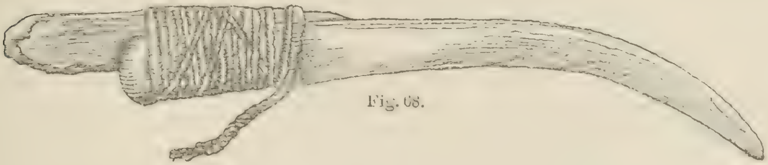


Fig. 68.

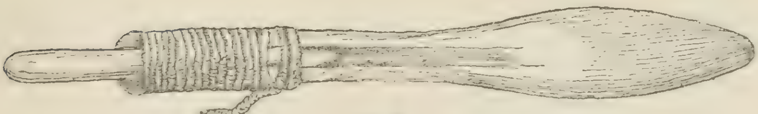


Fig. 69.

ESKIMO ARROW FLAKERS, POINT OF REINDEER HORN, HANDLE OF IVORY.

Evans, Ancient Stone Implements, p. 34, fig. 8.

As one corner or edge became worn, the hammer was turned in the hand to present another, until at last the corners were all worn off and the tool became practically a globe, when it is believed to have been unfit for further use and was discarded.

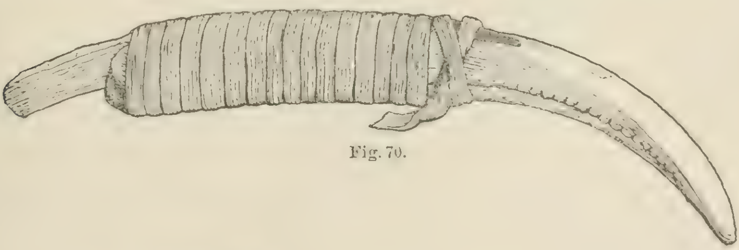


Fig. 70.

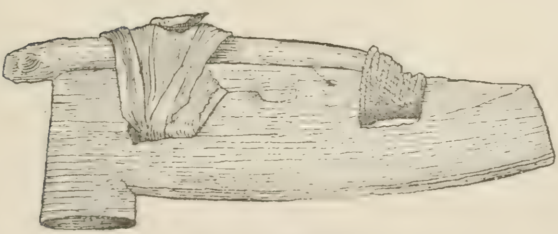


Fig. 71.

ESKIMO ARROW FLAKERS, POINTS OF REINDEER HORN, HANDLES OF WOOD AND IVORY.

Plate 5, fig. 11, represents a hammerstone from Spiennes, Belgium, and Plate 7, fig. 11, one from Grand Pressigny, France. In working

flint in modern times steel hammers are employed. (See Plates 8–10, figs. 62, 63.)

Mr. J. D. McGuire has published the result of some experiments on the hammerstone.[1]

In the inventory of tools the flaker must not be overlooked. Many of these have been found. The Eskimos use those of ivory fastened to a handle (figs. 68–71). These were used for chipping by pressure. The real prehistoric flakers have been found. They were simply pieces of bone or horn, usually the point of a deer horn, with sufficient length to insure a firm grip. The workman, having chipped his piece to proper form by percussion, desiring to bring it to an edge, took it in one hand, the flaker in the other, and by placing its point against the portion to be removed, with a pressure in the right direction and an artistic or

Fig. 72.

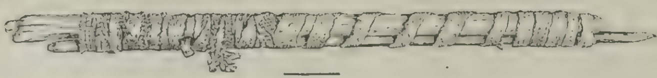


Fig. 73.

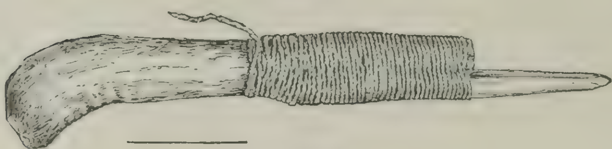


Fig. 74.

FLAKERS OF ANTLER OR BONE IN HANDLES OF WOOD.

Fig. 72.—Nevada Indians.

Smithsonian Contributions, XXII; Rau, Archæology, p. 95, fig. 340.

Figs. 73, 74.—Hupa Indians.

Smithsonian Report, 1886, Ray Collection, pl. XXI, figs. 92, 96.

mechanical twist of the wrist, he started a small flake of greater or less breadth, thickness, and length.

Figs. 72–74 are arrow flakers, the former used by the Indians of Nevada,[2] while the latter are from the Point Barrow Eskimos, Alaska, collected by Col. P. H. Ray, and described by Dr. O. T. Mason.[3]

The art of the prehistoric flint chipper requires a high order of mechanical dexterity. Some of the specimens show marvelously fine work—flakes so thin, wide, long, and regular as to extort our wonder and admiration. (Figs. 92, 151, from a mound near Naples, Illinois.)

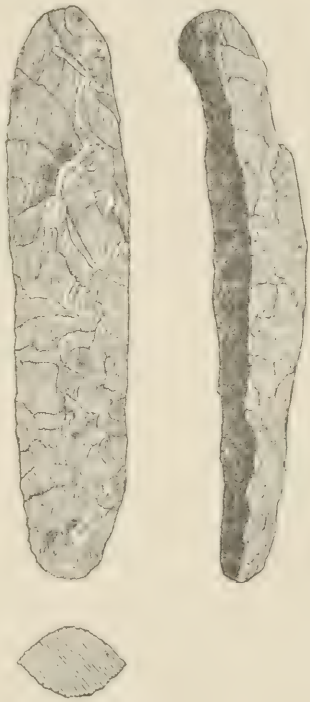
The flaking tools of Europe have never been satisfactorily determined. In the present condition the number of finely flaked objects is enormously out of proportion with the number of flakers found. Of those

[1] American Anthropologist, IV, pp. 301–12, 1891.

[2] Charles Rau, Archæol. Coll. U. S. Nat. Mus., p. 95, fig. 340.

[3] Ray Collection, Smithsonian Report, 1886, pl. XXI, figs. 92, 96.

implements found which might have served for this purpose, the number recognized and admitted as such is comparatively few. Some are of bone, some of horn, and others (strange to America) are of flint. Dr. Capitan, in the display of the Ecole d'Anthropologie at the Paris Exposition in 1889, showed a bone flaker, and he described and figured it in the report of that display made to the minister of public instruction. In the author's European collection are several implements of horn which probably served the same purpose. They are doubtless to be found in every collection. They are short, round, with a blunt point like one's little finger. This tool is usually of deer horn in its natural condition, long enough to have been held in the hand, but is sometimes cut short, with a possible tang as for insertion in a handle. Bone points are in every collection and are well known to every prehistoric archæologist; but they are sharply pointed as if for awls or perforators of skin or textile fabrics. The foregoing is a different implement and could never have served as an awl. One could no more punch a hole through a piece of skin with one of these than he could with the point of his finger, which it so much resembles. The author is of the opinion that they may have served as flakers. Tools similar in form are found of flint. Sir John Evans calls them fabricators or flaking tools[1] (figs. 75, 76). In France they have been called ecrasoirs, but M. de Mortillet prefers the name retouchoir, and says[2] that their extremities are smoothed by use. They served to flake by pressure (retouch) the flint implements. This operation had the effect of smoothing the ends of the involved implement. In Le Musée Prehistorique (Plate XLV, figs. 411-418) are several of these implements, chiefly from the interior of France. Sir John Evans[3] discusses these implements, but confesses his suggestions are by no means conclusive, and closes with the hope that future discoveries may throw more light on the subject. He figures and describes several from England, and says they are well known, and in Yorkshire are called



Figs. 75, 76.

FLINT FLAKERS (?) WITH SMOOTH ROUNDED ENDS, WORN BY USE.

Yorkshire, England.

Evans, Ancient Stone Implements, p. 367, fig. 346.

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[1] Ancient Stone Implements, p. 367.

[2] L'Homme Prehistorique, p. 517.

[3] Ancient Stone Implements, pp. 367-371.

"finger flints." His fig. 316 (p. 367) is from Yorkshire, and is here reproduced as figs. 75, 76. His description of it is that it is solid, symmetrically chipped, of gray flint, and is curved at one extremity, with a view of adapting it for being better held in the hand. The edges, originally chipped sharp, have been slightly rounded by grinding, apparently with the same motive. The angles at the curved end have been smoothed, but the other end is completely rounded and presents the worn, half-polished appearance characteristic of these tools. They vary much in the amount of workmanship they display, some being mere flakes with the edges rounded by chipping, and others as carefully wrought into form as any hatchet or chisel. They vary in length from 2 to 4 inches. The rougher kinds are usually clumsy in their proportions, as if strength was an object, and they not infrequently show a certain amount of abrasion at each end.

Many early explorers have witnessed the operation of arrowpoint making among the North American Indians and have described it in greater or less detail. These reports have been collected for the convenience of the student and teacher and are published as Appendix D (p. 985).

VII. SCRAPERS, GRINDERS, AND STRAIGHTENERS USED IN MAKING ARROW AND SPEAR SHAFTS.

These implements play a part in the science of prehistoric archaeology of an importance quite out of proportion with their appearance.

Spear and lance shafts, to be effective as weapons, must be straight and smooth. If rough or crooked, their effectiveness is much reduced. True, the most primitive spear made of a sapling, the point hardened by fire and left rough with knots and branches, might be a dangerous weapon in a hand to hand contest; but it would be more easily handled and more effective if made straight and smooth. For a javelin or arrow intended to be cast or thrown, either by the hand or with a bow, it is imperative that the shaft should be straight and smooth.

Many of the arrow shafts of antiquity were of reed or cane, perhaps because reed and cane were more plenteous and more easily adapted. They were the right size, could be made the right length, were light, straight, smooth, and required but slight preparation for use. Still, these would require some straightening and smoothing, and to that end tools were required.

In Europe the arrow-shaft scraper was used more than the arrow-shaft polisher or grinder; in America it seems to have been the reverse. In Europe, while polishers were used for many purposes, they seem not to have been much used on arrow shafts.

The arrow-shaft scraper (Plate 26) is a tool for that special purpose. It is of flint chipped to a concave edge. The specimen from England

EXPLANATION OF PLATE 26.

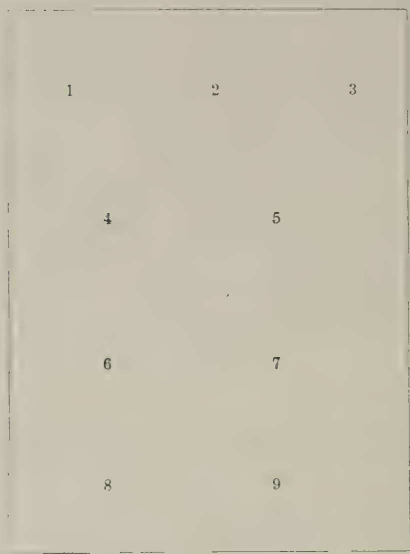


Fig. 1. From Yorkshire Wolds, England.
(Evans, Ancient stone implements, etc., p. 287, fig. 226.)

Fig. 2. From Chicago, Illinois.
(Carl Dilg.)

Fig. 3. From Indiana.
(Cat. No. 32367, U.S.N.M. Rev. F. M. Symmes and James Jones.)

Fig. 4. From Tennessee.
(Cat. No. 58720, U.S.N.M. James M. Null.)

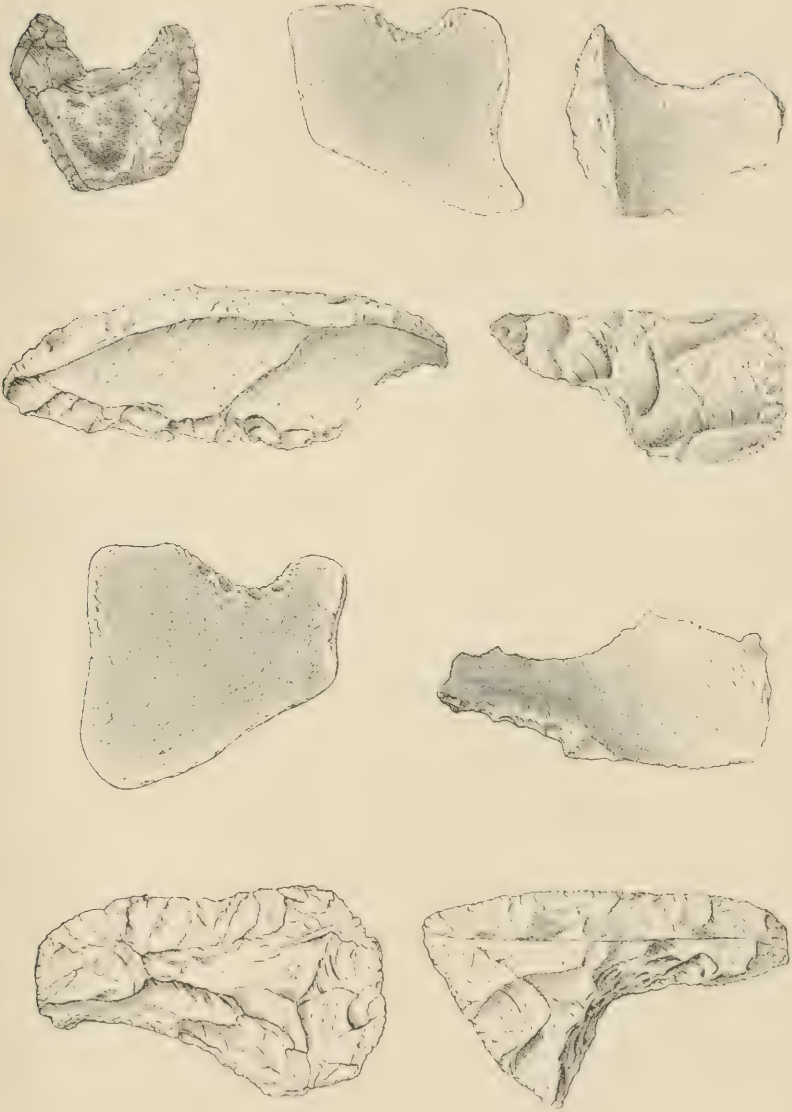
Fig. 5. From Indiana.
(Cat. No. 140746, U.S.N.M. H. Rust.)

Fig. 6. From Chicago, Illinois.
(Carl Dilg.)

Fig. 7. From Clarksville, Hamilton County, Indiana.
(Cat. No. 140743, U.S.N.M. H. Rust.)

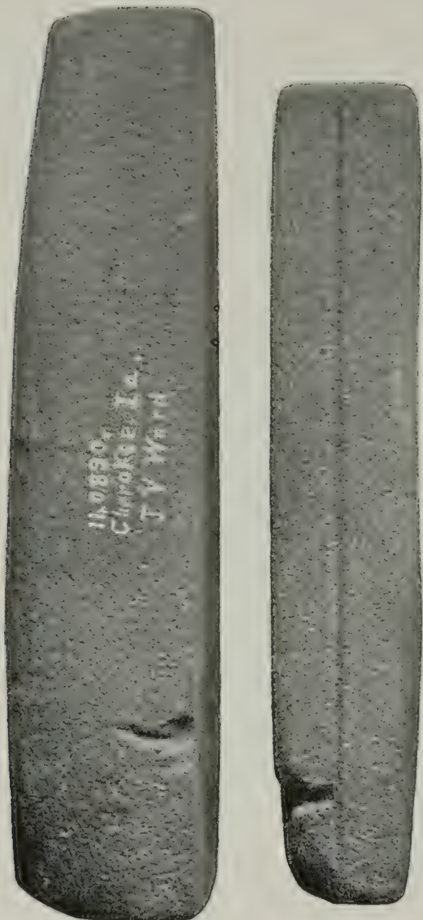
Fig. 8. From California.
(Cat. No. 30508, U.S.N.M. S. Bowers.)

Fig. 9. From Ohio.
(Cat. No. 139958, U.S.N.M. Thomas Wilson.)



CONCAVE ARROWSHAFT SCRAPERS OF FLINT.

England and United States.



ARROWSHAFT GRINDERS.

Loose gritty sandstone.

Cherokee, Iowa.

Cat. No. 140890, U.S.N.M.

(fig. 1) comes from Yorkshire Wolds, and is taken from Sir John Evans's Ancient Stone Implements,[1] where it says:

Tools of this kind are well adapted for scraping into regular shape the stems of arrows or the shafts of spears, or for fashioning bone pins.

The round-ended scraper, supposed to have served for scraping skins, had a common form in Europe (Plate 12) and America. They may have been used for scraping arrow shafts in either or both countries, but of this we have no evidence save their plenteousness and the possibility of such use. Eskimos continued the use of the round-ended scraper, inserted in either wooden or ivory handles, until modern if not until present times. They have been figured and described by Sir John Lubbock,[2] Sir John Evans,[3] and Dr. O. T. Mason.[4]

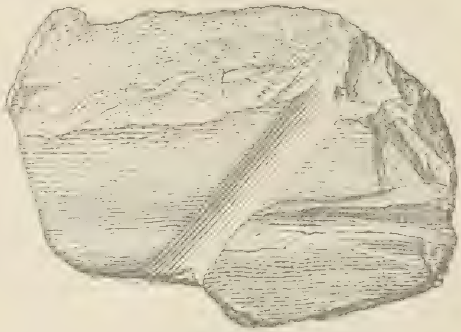


Fig. 77.

ARROW-SHAFT GRINDER, CHLORITE SLATE.

Cape Cod, Massachusetts.

Cat. No. 17868, U.S.N.M. ½ natural size.

But the scrapers with a concave edge, for scraping arrows, are rarely found in prehistoric collections, nor are they reported among the Indians of North America. The U. S. National Museum possesses some, but not many. They seem not to have been recognized or cared for and were not gathered by collectors. Figs. 1–8 in Plate 26 are seven specimens inserted as examples of thirty or forty from the Ohio and Mississippi valleys.[5]

Dr. Charles Rau, in an unpublished manuscript, divided some arrow-making implements into arrow-shaft grinders and straighteners, though he admits that both might have been used for smoothing the shafts.

Fig. 77 represents an arrow-shaft grinder, with a straight groove of suitable size, of compact chlorite slate from Cape Cod, Massachusetts (Cat. No. 17868, U.S.N.M.). As the stone is not at all gritty, the process must have been performed with the assistance of sand and water.

Plate 27 contains specimens of what are supposed to have been arrow-shaft grinders. They are coarse sandstone, exceedingly gritty, and would serve the purpose well. The top is rounding or oval, the sides parallel, while the bottom is flat, with a groove in it, as shown in the specimen. The size is indicated by the scale. They are from Cherokee, Iowa. Similar ones have been found in other localities.

Somewhat allied to the arrow-shaft grinders are the arrow-shaft straighteners—more or less carefully prepared stones, generally of

[1] Page 287, fig. 226.

[2] Prehistoric Times, 4th ed., p. 513, figs. 214–216.

[3] Ancient Stone Implements, p. 268, fig. 203.

[4] Report U. S. National Museum, 1889, pp. 553–589, pls. LXI–XCIII.

[5] Robert Munro, Prehistoric Problems, 1897, p. 329, figs. 117, 118.

oblong form and exhibiting on the upper face a groove, or sometimes two or three parallel grooves, for receiving the arrow shafts (fig. 78). The grooves are mostly smooth and shining from long usage. Mr. Paul Schumacher found a number of these implements in southern California graves, and he describes their application.[1] The stones were heated and the crooked shafts rubbed back and forth in the grooves under pressure until they became straight. As the stones had to withstand a considerable degree of heat, serpentine, a material possessing that quality, was generally chosen. Straighteners of the ruder kind were made in California of fragments of soapstone vessels. The Apaches and other western tribes used until lately very neat straighteners of serpentine, often provided with two grooves. The author, however, was informed that they did not heat the stone, but heated the shafts, and then pressed them back and forth in the grooves. Some of the California specimens have been crackled by the heat to which they were exposed. From the uniform polish of the grooves, it may be inferred that such stones were also used for smoothing the shafts. Similar utensils, apparently for the same use, are in the Museum collection, ranging in locality from Massachusetts to California.

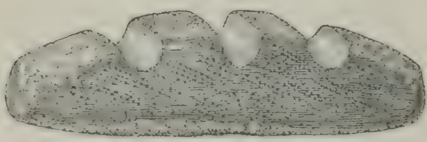


Fig. 78.

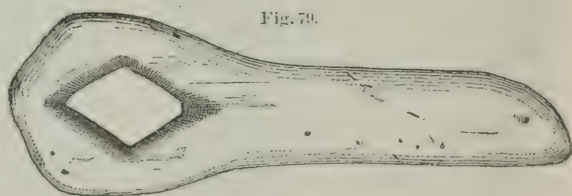
SERPENTINE ARROW-SHAFT STRAIGHTENER WITH THREE SMOOTH GROOVES, ORNAMENTAL IRREGULAR INCISED LINES.

Santa Barbara County, California.

Cat. No. 20215, U.S.N.M. ½ natural size.

The Eskimos used a different tool for straightening their arrow shafts. It was a piece of bone, or frequently ivory, heavy and solid, with an enlargement at the upper end through which was a perforation usually of lozenge shape. The arrow shaft was put through this hole, and the instrument, used as a wrench, bent the shaft as was required to make it straight. Dr. Boas figures one of them[2] (fig. 79), and European prehistoric archæologists have frequently done the same.[3]

Fig. 79.



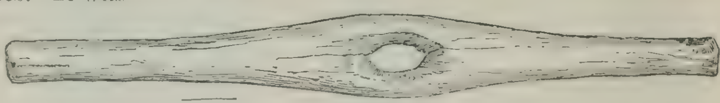


Fig. 80.

ARROW-SHAFT STRAIGHTENERS OF WOOD OR IVORY.

Fig. 79, Central Eskimo.

6th Ann. Rept. Bur. Ethnol., 1884–5, fig. 474, p. 525.

Fig. 80, Hupa Indians. Smithsonian Report, 1893, pl. xxxix, fig. 1.

[1] Archiv. für Anthropologie, IX, p. 249.

[2] Central Eskimo, Sixth Ann. Rept. Bur. Ethnol., 1884–85, p. 525, fig. 474.

[3] Boyd Dawkins, Early Man in Britain, p. 238, fig. 92.

Dr. Hoffman, in his article entitled "The Graphic Art of the Eskimo,"[1] figures a half dozen of these similar in some regards to those already shown. They are from Cape Nome, Sledge Island, Diomede, and Cape Darby, all on the Alaskan coast. He introduces these in the attempt to correlate them and similar specimens of Eskimoan art with that of the Paleolithic period as manifested in the specimens from the caverns of Dordogne, France, a proposition to which the author does not agree.

Fig. 80 is an arrow-shaft straightener used by the Hupa Indians of California. It is a piece of yew, 10 inches long, spindle-shaped, and having an oblong hole through the middle. The arrow shaft is drawn through the hole and straightened by pressure on the ends of the tool.[2]

VIII. CLASSIFICATION OF ARROWPOINTS AND SPEARHEADS.

I, leaf-shaped; II, triangular; III, stemmed; IV, peculiar forms.

Dr. Rau had prepared a paper entitled "The Typical Forms of North American Prehistoric Relics of Stone and Copper in the United States National Museum," but he died before it was completed. It has always been the author's intention to complete and publish this paper. That portion of the text relating to arrowpoints and spearheads is as follows:

ARROW AND SPEARHEAD SHAPED OBJECTS.

They constitute the most numerous class of chipped-stone articles in the United States. Collectors are very apt to designate indiscriminately all objects of dart-head-like form, as arrow or spear points, without considering that many of these specimens may have been quite differently employed by the aborigines. Thus several Western tribes used, within recent times, chipped-flint blades identical in shape with those that are usually called arrow and spear heads, as knives, fastening them in short wooden handles by means of a black resinous substance or asphaltum.

The stone-tipped arrows quite recently made by various Indian tribes are mostly provided with slender points, often less than an inch in length, and seldom exceeding an inch and three-quarters, as exemplified by many specimens of modern arrows in the National Museum. If this fact be deemed conclusive, it would follow that the real Indian arrowhead was comparatively small, and that the larger specimens classed as arrowpoints, and not a few of the so-called spearheads, were originally set in handles and were used as knives and daggers. However, it is not improbable that in former times larger arrowheads were in use among the natives.

In many cases, further, it is impossible to determine the real character of leaf-shaped or triangular objects of chipped stone, as they may have served as arrow-heads, or either as scrapers or cutting tools in which the convex or straight base formed the working edge. Certain chipped spearhead-shaped specimens with a sharp straight or convex base may have been cutting implements or chisels. Arrow-heads of a slender form pass over almost imperceptibly into perforators, insomuch that it is often impossible to make a distinction between them.

In view of these uncertainties, the writer has brought the arrow and spear point shaped objects under one head, which is the more excusable as, generally speaking, size is the only distinguishing feature.

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[1] Report U. S. National Museum, 1895, p. 765, pls. 7, 8.

[2] Otis T. Mason, North American Bows, Arrows, and Quivers, Smithsonian Report, 1893, pl. XXXIX, fig. 1.

The attempt is here made to segregate and classify arrowpoints, spearheads, and knives. In Europe they have always been denominated arrowpoints or spearheads, determinable only by their size; in the United States, by comparison with those of the Indian of historic time, we have been able to draw the line of demarcation possibly with greater accuracy. We have also discovered, through the prehistoric as well as the historic Indians, that these implements may have been used as knives; therefore, in the headings, they have been denominated by all three names—arrowpoints, spearheads, and knives.

No racial or tribal classification is here attempted from these implements. If classified according to material, and afterwards divided geographically, they ought to tell of the difference in the various peoples using them, if any such existed. This work the author has yet before him.

We have already seen that the material employed would be that which would serve the purpose best and was nearest and most easily obtained. The elements of commerce and ease of transportation must be regarded in ascertaining the locality of the material. To correctly determine this, we must consider the known facts as to distance, quality, weight, and value of material transported.

The present classification is based on the form and size of the implement. In order that the series contemplated by the present classification shall be as complete as possible, those from Europe which belong to the earlier epochs are included. The weapons of the Paleolithic period—the Chelléen implements, the Mousterien spear points, the Solutréen leaf-shaped and one-shouldered points, and the Madelainien points and harpoons—have been already described, and we have concluded that they may have served as spears, lances, javelins, or harpoons, but not arrowpoints or knives. The leaf-shaped implements used as spear and harpoon heads in the Paleolithic period continued into the succeeding prehistoric periods, and were then used as arrowpoints as well as for spears or harpoons. This does not clash with the theory that arrows were not used during the Paleolithic period.

A classification of arrowpoints and spearheads has been attempted by but few archæologists. Sir John Evans,[1] General Pitt-Rivers,[2] Sir W. R. Wilde,[3] and Dr. Charles Rau are the principal ones who have essayed a classification, but in their descriptions they scarcely employed their own. The first two gentlemen made four classes. Some of the classifications were arranged according to probable successive development, thus: leaf-shaped, lozenge-shaped, tanged or stemmed, and triangular. Sir W. R. Wilde (and Sir John Lubbock follows him) arranged them thus: triangular, indented base, stemmed, barbed, and leaf-shaped. Dr. Edwin A. Barber[4] as follows: leaf-shaped, triangular,

[1] Ancient Stone Implements of Great Britain, pp. 328–364.

[2] Primitive Warfare, Jour. R. U. Service Inst.

[3] Catalogue of Antiquities, Royal Irish Acad., pp. 19, 21, 23.

[4] American Naturalist, XI, p. 265.

indented at the base, stemmed, barbed, beveled, diamond-shaped, awl-shaped, and those having the shape of a serpent's head. Dr. Abbott[1] does not make any formal classification, but uses as descriptive terms: barbed, triangular, leaf-shaped, lozenge-shaped, notched base, serrated, stemmed, barbed triangular, triple-notched-based, unsymmetrical. Dr. Rau originally made a classification of 22 subdivisions, but in the paper prepared just before his death, he made another, as follows:

Convex or straight-sided (rarely concave-sided) with convex, straight, or concave base.

Notched at the sides near the base, which is convex, straight, or concave, rarely pointed.

Stemmed; expanding stem with convex, straight, or concave base.

Stemmed; parallel-sided stem with convex, straight, or concave base.

Stemmed; contracting straight-sided stem with convex, straight, or concave base.

Stemmed; contracting broad stem with rounded or pointed termination.

Stemmed; tapering stem.

Barbed and stemmed.

Leaf-shaped implements; rounded at one end, pointed at the other; pointed at both ends; rounded at both ends.

The making in my department during the year 1891–92, of the 100 series of 100 casts each of typical implements of the United States, for educational purposes, afforded the opportunity, if it did not create the necessity, for a comprehensive classification. To send out a series of arrowpoints or spearheads without classification or name would be a waste of time and labor; while, if made of plaster, they would be so fragile as to be a waste of money as well. Therefore I prepared series of these implements, classified them by type, arranged them by size, and had them photographed and engraved, each class by itself so they might be understood almost as well as from an inspection of the originals. It was found necessary to employ many specimens to make a proper display. Many of these objects in the same division are similar in form, appearance, and material, the main difference being in their size. But this difference of size may change the character, use, and name of the weapon, and it may, according to size, become an agricultural implement used for digging in the earth a spear, dagger, poniard, scalping or fish knife, or an arrowpoint or lancet. All these sizes of implements with uses and names are known to students of prehistoric archaeology and collectors of antiquities. This difference in size is a reason for giving many cuts of the same form of implements but of different sizes. A large implement, if reduced in size, represents to the eye of the beholder a small one. He has seen both the large and the small one, is acquainted with both, and when he sees a cut of given size which is a correct representation of a small implement, he will involuntarily associate it with the real implement of small size. The author has seen an engraving of one of these large digging implements, the original of which was 16½ inches long and 5 inches

[1] Primitive Industry.

wide. The drawing was reduced to one-third, and the engraving one-half from the drawing. Thus this large and formidable implement was represented by a figure $2\frac{3}{4}$ inches by five-sixths of an inch, which is but the size of a common arrow or spear head. No rule or scale can give it its true appearance in the eyes of the majority of readers. These engravings are intended to serve as a classification of these implements by which their names, and possibly their functions, may be known, and by which archaeologists throughout the country, and perhaps the world, may be better enabled to understand and describe them. When we consider that it is beyond the power of mere words to describe a form, and that a figure, cut, or representation of it must be or must have been made at some time in order to communicate knowledge of a form to any person who has not previously seen it, the author trusts he will be justified in the classification and the engravings by which it is sought to be represented.

The names of the different parts of stone arrowpoints and spearheads or knives are: blade, point, stem, base, edge, shoulder, barb, notch.

The failure of many archaeologists (and it is not confined entirely to them) to make a distinction between the words "side" and "edge" has led to a confusion in description. "Border," "rim," "margin" are, or may be, synonymous with "edge," but "side," although much used in this sense, is almost always erroneously used. We say the "side" of a table when we mean the edge, the border, the margin, that part farthest from the center or middle. Applying it to a plank or sword or arrowpoint or spearhead, we should say "edge." "Edge" is particularly appropriate for swords and arrowpoints and spearheads, as it applies specially to the "sharp and thin cutting border or extremity of an instrument."

The author has sought to make his classification as simple as possible. Minute or complex divisions will never be adopted in popular usage. They will be difficult to understand and are impracticable in that they can not be easily remembered or readily applied.

In the author's classification the primary divisions of arrowpoints, spearheads, or knives are as follows:

Division I, leaf-shaped.—In this classification the leaf-shaped is placed at the head as being the oldest implement of its kind. This division includes all kinds: elliptical, oval, oblong, or lanceolate forms bearing any relation to the shape of a leaf, and without stem, shoulder, or barb.

Class A is pointed at both ends, the widest place one-third or one-fourth from the base.

Class B is more oval, less pointed, with base concave, straight, or convex.

Class C is long and narrow, sharp points, parallel edges, and bases concave, straight, or convex. These belong to the Pacific coast.

Division II, triangular.—This division includes all specimens which, according to geometrical nomenclature, are in the form of a triangle, whether the bases or edges be convex, straight, or concave. They are without stems and consequently without shoulders, though in some specimens the extreme concavity of the base produces barbs when the arrow shaft is attached.

Division III, stemmed.—This division includes all varieties of stems, whether straight, pointed, or expanding, round or flat, except those with certain peculiarities and included in Division IV; and whether the bases or edges are convex, straight, or concave.

Class A is lozenge-shaped, not shouldered nor barbed.

Class B is shouldered, but not barbed.

Class C is shouldered and barbed.

These cover the commoner forms of arrowpoints and spearheads throughout the world. But there are certain other forms which may be few in number or restricted in locality and scarcely entitled to divisions by themselves, yet are found in sufficient numbers and have such definite characteristics that they can not be ignored. These the author has assigned to a general class under the head of "peculiar forms."

Division IV, peculiar forms.—This division includes all forms not belonging to the other divisions, and provides for those having peculiarities, or the specimens of which are restricted in number and locality.

Class A, beveled edges.

Class B, serrated edges.

Class C, bifurcated stems.

Class D, long barbs, square at ends. Peculiar to England, Ireland, and Georgia, United States.

Class E, triangular in section. Peculiar to the province of Chiriqui, Panama.

Class F, broadest at cutting end, tranchant transversal. Peculiar to western Europe.

Class G, polished slate. Peculiar in North America to the Eskimo country and to New England and New York.

Class H, asymmetric.

Class I, curious forms.

Class K, perforators.

DIVISION I—LEAF-SHAPED.

The author essayed botanical and geometrical terms in this description, but found them unsatisfactory. The implements have such variety of form, each slightly different from the other, that specific terms were scarcely ever applicable. They are lanceolate, as already mentioned; leaf-shaped, but as leaves have many different forms, so have these implements, and "leaf-shaped" is rather generic than specific. He essayed the geometrical terms of ovate, oblong, truncated, elliptical, lenticular, but found he could only use them in descriptions of individual specimens.

Dr. Rau, in his unpublished paper, speaking of leaf-shaped implements, said:

These are numerous and of great variety in form and size, insomuch that a minute classification would be difficult. However, they can be divided in a general way into three classes, in accordance with their being rounded at one end and pointed at the other, or pointed at both ends, or rounded at both ends. They vary in length from less than an inch to more than 13 inches, and there is in the National Museum a cast of a sword-like flint blade measuring more than 21 inches in length, which by its form pertains to the class here treated. The original, from a mound in Tennessee, is in the possession of Dr. Joseph Jones, of New Orleans.

Fig. 81 represents a dagger from Madison County, Kentucky. It is dark-brown, much weathered, and difficult to determine its material, probably flinty chert or hornstone. While not the classic leaf-shaped implement which might have been inserted in a shaft and served as a spear, but partaking more of the character of a sword or long dagger to be held in the hand with a wrapping of skin, as shown in specimen from Hupa Valley, California (fig. 78, Plate 41, Cat. No. 126530, U.S.N.M.), yet it is a type of many specimens in North America. A similar specimen in the U. S. National Museum is Cat. No. 88122, from Arkansas, collected by Mr. Edward Palmer, of chalcedonic flint, 12 inches long, 2 inches wide, and three-eighths of an inch thick. It is sharply pointed at both ends and its fine chipping has served to make its edges slightly serrated.

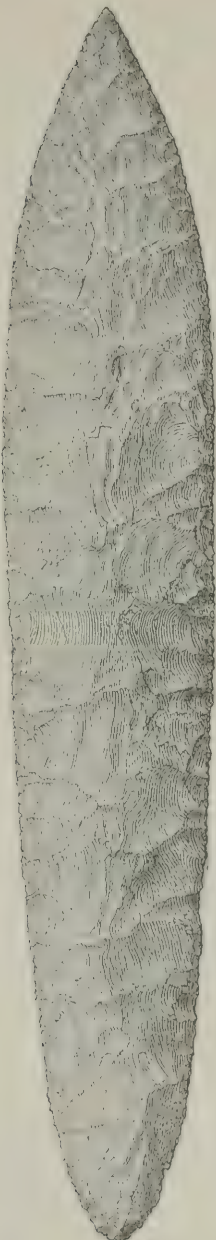


Fig. 81.
LEAF-SHAPED SPEARHEAD OF FLINTY CHERT, POINTED AT BOTH ENDS.
Madison County, Kentucky.
Division I. Class A. $13 \times 2\frac{1}{4} \times \frac{3}{8}$.
Cat. No. 2407, U.S.N.M.

The specimen, Cat. No. 99823 (U.S.N.M.), the first one on Plate 32, is a piece of beautiful work in flint chipping. The flakes taken off have been long, thin, and fine, and ran from the edge to the center, and have given to it a keen, sharp edge. The specimen is of oolitic chert, $12\frac{1}{2}$ inches long, $3\frac{3}{4}$ inches wide, and three-fourths of an inch thick.

Other specimens are represented in figs. 82 and 83. They are not, and never were, intended for arrowpoints or spearheads, but rather as swords or possibly ceremonial objects; but as they are leaf-shaped, and from their great length and beauty, with the difficulty of their manufacture, they have been admitted to a place in this paper. Fig. 82 is from an ancient earthwork on the Big Harpeth River, near Franklin, Tennessee. Fig. 83 is from a mound in Oregon.

General Thruston[1] figures and describes many of these long and finely chipped specimens from Tennessee.

[1] Antiquities of Tennessee, pp. 219–252, pls. XI, XIV*a*.

Dr. Rau says of this class:

> Some are broad in proportion to their length, others are very slender. The mode of application of these variously shaped implements is doubtful in most cases, but some aid in judging of the use of certain leaf-shaped blades is afforded by the fact that similar ones have been seen shafted or handled in actual employment among modern Indian tribes. It is difficult to draw a line of demarcation between rude and leaf-shaped implements, considering that the former very often approach the leaf form, not only in North America, but also in other quarters of the globe where man had to employ stone in fashioning his tools and weapons.

Fig. 82.

SWORD OF DARK BROWN FLINT.

Williamson County, Tennessee.

Division I, leaf-shaped. $22 \times 1\frac{7}{8} \times \frac{5}{8}$.

Cast, Cat. No. 11481, U.S.N.M.

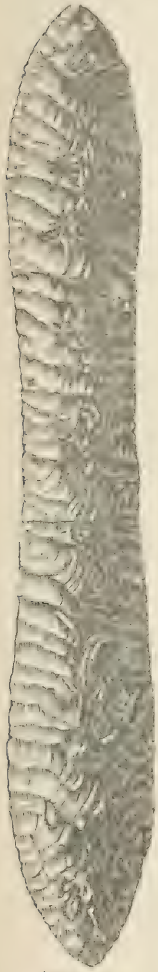


Fig. 83.

SWORD OF OBSIDIAN.

Oregon.

Division I, leaf-shaped. $15 \times 2\frac{1}{4} \times \frac{5}{8}$.

Cast, Cat. No. 30190, U.S.N.M.

This last remark of Dr. Rau is certainly true as regards the leaf-shaped implement of the Solutréen or Cavern period of the Paleolithic age, but has slight application to those of the Chelléen epoch or Alluvial period. The difference is quite apparent to any person who has any acquaintance with the latter implements. The confusion between the two kinds of implements arises, usually or frequently, among those who depend upon cuts and illustrations for their knowledge rather than on an acquaintance with the real objects. Their error is caused by the illustration usually being of only the flat side without any edge view. The two classes of implements may have a resemblance of outline and of chipped work when looked at from the flat side, but an edge view would reveal the difference at once. The leaf-shaped implement is chipped down thin, frequently to one-fourth of an inch, while the Chelléen implement is more likely to be from 1 to $1\frac{3}{4}$ inches in thickness. A glance at the folded plate at the end of Sir John Evans's Ancient Stone Implements will show this peculiarity. Reference is made to figs. 1, 2.

Fig. 84 presents the same appearance from a side view as the leaf-shaped. This impression is erroneous. The implement is not one properly called leaf-shaped, and the difference is recognizable by a glance at the specimen. The leaf-shaped implements proper are thin; their thickness is from one fourth to one-fifth of their width; only one of these here shown is more than one-half inch in thick-

ness. The thickness of the implement represented by this figure is from one-third to one-half of its width. Its thickness makes the difference. The author would not affirm that objects of this class belong to a different epoch or were made by different prehistoric people, nor the difference in the use for which they were intended. The leaf-shaped implements are themselves quite too doubtful on these questions to justify dogmatism on the part of any person, and the latter implements with their differences serve to increase rather than diminish the difficulties of a satisfactory decision. The two figures (85 and 86) present the same idea. From the side view alone one would not know the difference

Fig. 84.

FERRUGINOUS CONGLOMERATE CONTAINING JASPER PEBBLES.

Blount County, Alabama.

Not leaf-shaped (inserted for comparison). $9\frac{7}{8} \times 2\frac{3}{4} \times 1\frac{1}{2}$.

Cat. No. 61943, U.S.N.M.

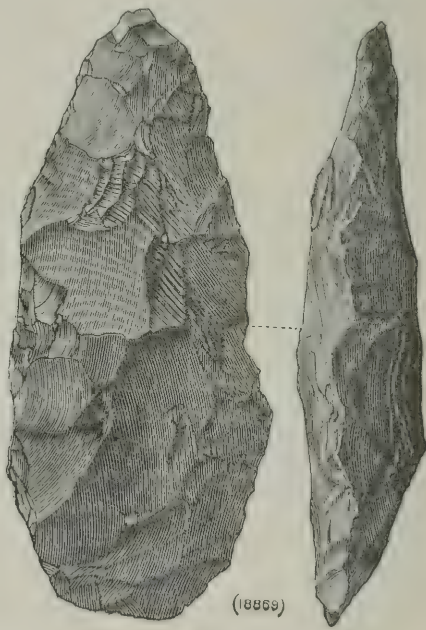


Fig. 85.

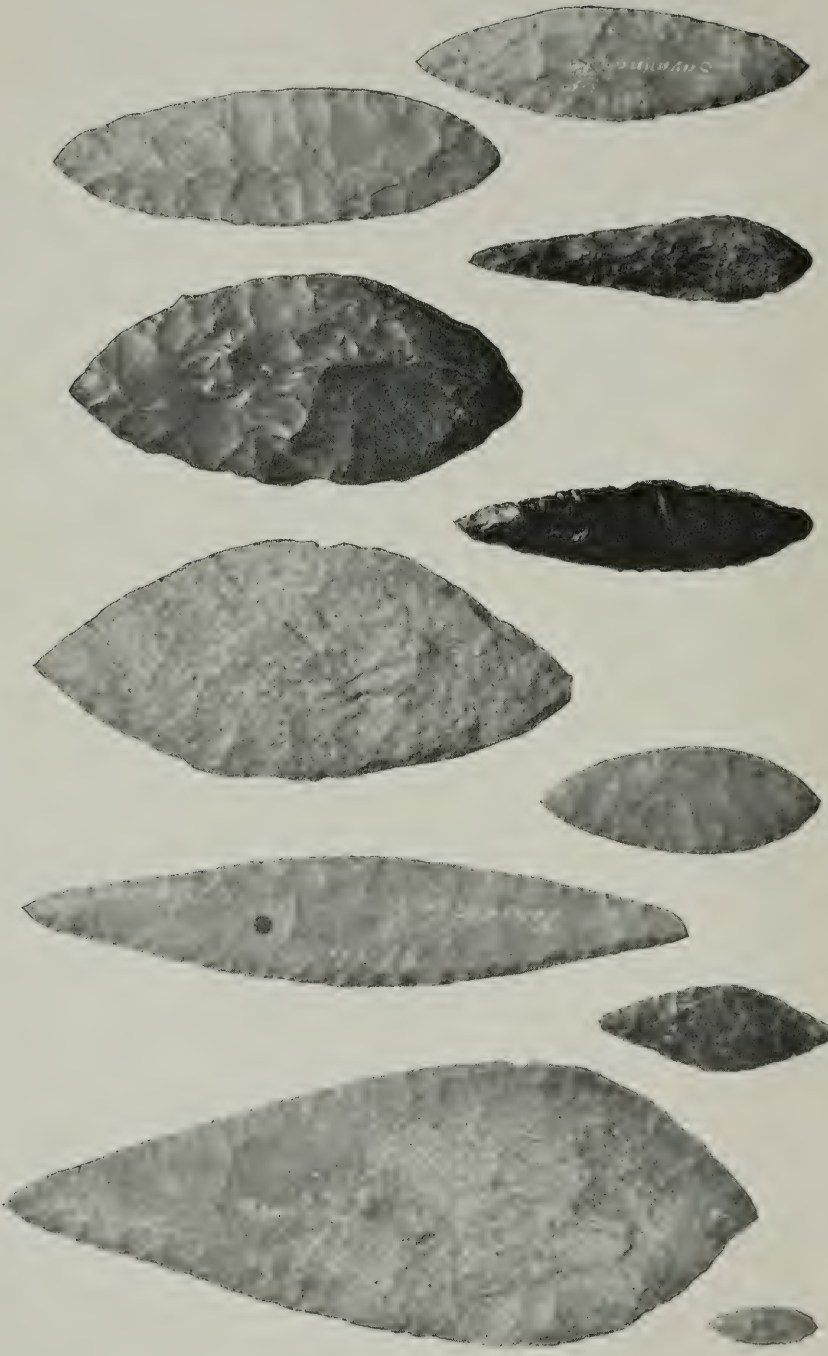
PALE GRAY FLINT HAVING THE APPEARANCE OF AGATIZED WOOD.

Austin, Texas.

Not leaf-shaped (inserted for comparison). $6\frac{1}{2} \times 2\frac{3}{4} \times 1\frac{1}{4}$.

Cat. No. 18869, U.S.N.M.

between these implements and those following. But with the thickness remarked one recognizes at a glance that these are not in any sense the leaf-shaped implements we have been considering. They are not made by the same primitive man, nor do they belong to the same epoch of civilization. In Europe the thick one belongs to the earliest epoch



LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class A.

EXPLANATION OF PLATE 28.

1 2 3 4 5

11 10 9 8 7 6

Leaf-shaped Arrowpoints, Spearheads, or Knives.

Class A.

Fig. 1. Fine Quartzite.
(Cat. No. 98820, U.S.N.M. Cholulu, Mexico. W. W. Blake.)

Fig. 2. Dark Chalcedony.
(Cat. No. 9784, U.S.N.M. Dudley Township, Hardin County, Ohio. W. W. Murch.)

Fig. 3. Quartzite.
(Cat. No. 6440, U.S.N.M. Northampton County, Virginia. C. R. Moore.)

Fig. 4. Jasper or Jaspery Flint.
(Cat. No. 6633, U.S.N.M. Trinity, Louisiana. G. M. Keim.)

Fig. 5. Dark-Gray Chalcedony or Flint.
(Cat. No. 61513, U.S.N.M. Bowling Green, Kentucky. Dr. John R. Younglove.)

Fig. 6. Pinkish Flint.
(Cat. No. 9880, U.S.N.M. Savannah, Tennessee. J. P. Stelle.)

Fig. 7. Light-Brown Flint.
(Cat. No. 5406, U.S.N.M. District of Columbia. J. Varden.)

Fig. 8. Black Lustrous Obsidian.
(Cat. No. 18088, U.S.N.M. California. J. H. Clark.)

Fig. 9. Light-Brown Quartzite.
(Cat. No. 7063, U.S.N.M. Union County, Kentucky. S. S. Lyon.)

Fig. 10. Black Flinty Chalcedony.
(Cat. No. 15280, U.S.N.M. Santa Barbara County, California. Paul Schumacher.)

Fig. 11. Pale-Gray Chalcedony.
(Cat. No. 15754, U.S.N.M. San Miguel Island, California. W. G. Harford.)

of the Paleolithic period, and the thin one, pointed at both ends, to a much later epoch. The first belongs to the Chelleen, Mammoth, Cave-bear, or Alluvium epoch; the second to the Solutréen, Reindeer, or Cavern epoch.

The distinctions between these epochs have not been made in the United States, and possibly do not exist. But the author has ventured to investigate whether the Paleolithic period had not possibly an existence in the United States, and to suggest that these rude and thick implements, acknowledged by all to be so characteristic of the Paleolithic period in Europe, and so unknown to the Neolithic period in both Europe and America, may not have been its representatives.

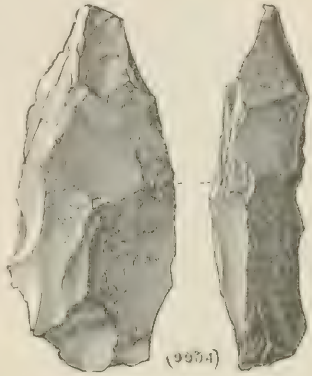


Fig. 86.

YELLOW CHERT.

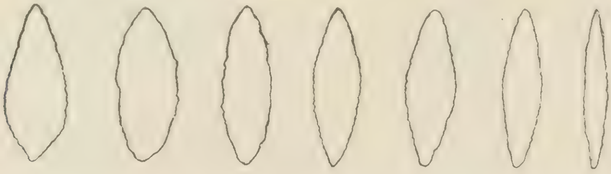
Shell-heap on Tennessee River opposite Savannah, Tennessee.

Not leaf-shaped (inserted for comparison.) $3\frac{7}{8} \times 1\frac{3}{4} \times \frac{7}{8}$.

Cat. No. 9904; U.S.N.M.

Of the thin, true leaf-shaped implements in some of their forms, the author has said they seem to have belonged to both periods, and so their discovery, unsupported by associated objects, is not evidence as to either period. He trusts he has explained the differences between these implements, the thick and the thin—that though from the side view they have great resemblance, yet are really widely separated in culture, time, and art—and he hopes the reader will not confound them.

CLASS A.—POINTED AT BOTH ENDS. (Plate 28.)



This class corresponds to the Solutréen type of the Paleolithic period in France. It is pointed at both ends; it approaches the elliptical and the oval, but is not regular in either form, for its greatest width is about one-fourth to one-third the distance from the base to the point. In France this is called "feuille de laurier" (laurel leaf). It is symmetrical, quite thin, the edges and sides having been chipped with great delicacy and fineness. According to botanical nomenclature it approaches the lanceolate. The appearance of this implement in Europe during the Paleolithic period and its continuance into and through the Neolithic period have been described on p. 828, and need not be repeated. This implement and the convex scraper are common to both periods, and are the two implements which belong equally to the Paleolithic and Neolithic periods.

The following illustrations give a fair idea of these implements in North America. They run the entire range of size, from the very large to the very small. Plate 25 has a fragment of a large one of obsidian from Cordova, Mexico.

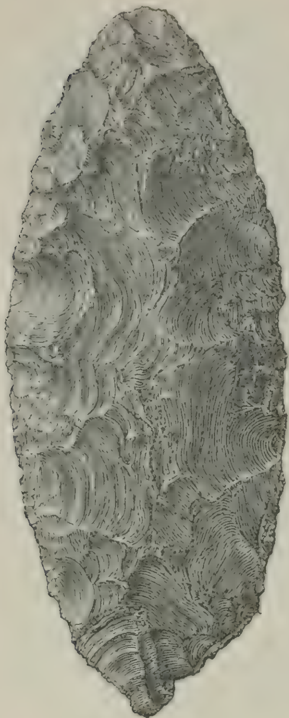


Fig. 87.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

Folsom, Sacramento County, California.

Division I, Class A. $7\frac{1}{2} \times 3 \times \frac{1}{2}$.

Cat. No. 7342, U.S.N.M

Fig. 87 is a leaf-shaped implement from Folsom, California, of symmetrical form, though chipped in rough and rather large flakes. It bears the evidence of use. It may have been handled and used as a spear, or it may have had a skin or other wrapping and been used as a knife or dagger.

Fig. 88 is from St. George, Utah. It is of flinty chert, and is a wonderful piece of art in flint chipping. The flakes run to the center, and so have reduced the thickness to the minimum, which is one-eighth of an inch. It is unfortunately broken in three pieces, one of which is lost.

Fig. 88.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

Division I, Class A. $10\frac{1}{4} \times 2\frac{1}{4} \times \frac{1}{8}$.

Cat. No. 21014, U.S.N.M.

Fig. 89 is a very thin specimen of fine-grained flinty chert from Union County, Kentucky, and is fig. 9 on Plate 28, Class A.

Fig. 90, from Northampton County, Virginia, is of quartzite and represents a type prevalent along the Atlantic seaboard from the Potomac to the James rivers. It is found in abundance in the neighborhood of Washington City (Plate 28, fig. 3).

Fig. 91 is of chalcedony, delicately chipped, pointed at both ends, and is symmetrically lenticular (Plate 28, fig. 10). Fig. 92 is of obsidian, is similar to fig. 91, but thicker, and its greatest width is nearer the base (Plate 28, fig. 8).

A characteristic of the Mousterien (Paleolithic) point is that it was made from a flake struck from the nucleus with a single blow, and the under or flat side was left unchipped and untouched, while the top or outside was wrought by chipping to a fine edge and point. Fig. 93 is almost unique among American specimens in the U. S. National Museum in the possession of this characteristic. The illustration is of the top side, and it shows the chipping; the other side is a clean fracture with no chipping. The specimen is pale-bluish chalcedony, translucent, and comes from Mexico. It is pointed at both ends and belongs to Class A, leaf-shaped. Fig. 94 is leaf-shaped, elliptical, pointed at both ends, and belongs to Class A. It comes from Georgia. The material is the gray pyromachic chert similar to the large disks (Plates 62–63) found in caches in Ohio and Illinois. The tip-end of the base shows the crust of the pebble from which the implement was made. In general appearance it resembles the others of Class A, but has a distinguishing difference which may assist in determining the method of use of this style of implement. It has two notches opposite each other in the edges near the base, evidently intentional, and which we may assume were for attachment of a handle by ligature. The implement is quite too heavy for an arrowpoint; it might be a spear, but for this; another having the same weight, but shorter and thicker, would serve equally well and not be fragile nor in continual danger of breakage. Whether it was intended

Fig. 89.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

Division I, Class A.

$2\frac{7}{8} \times 1\frac{1}{3} \times \frac{3}{16}$.

Cat. No. 7063, U.S.N.M.

Fig. 90.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

Division I, Class A.

$5\frac{3}{4} \times 2\frac{1}{2} \times \frac{1}{2}$.

Cat. No. 6440, U.S.N.M.

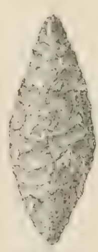


Fig. 91.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

Santa Barbara County, California.

Division I, Class A.

$2\frac{3}{8} \times \frac{7}{8} \times \frac{1}{4}$.

Cat. No. 15280, U.S.N.M.

Fig. 92.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

California.

Division I, Class A.

$3\frac{3}{4} \times \frac{7}{8} \times \frac{3}{8}$.

Cat. No. 18088, U.S.N.M.

Fig. 93.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS.

National Museum, Mexico.

Division I, Class A.

$4\frac{3}{4} \times 2\frac{1}{8} \times \frac{1}{2}$.

Cat. No. 31651, U.S.N.M.

for use as a spear, arrow, knife, or dagger, can be determined positively only by the handle itself, of which, unfortunately, no traces were found.

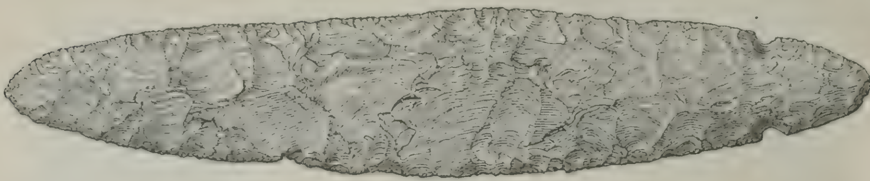


Fig. 94.

LEAF-SHAPED IMPLEMENT, POINTED AT BOTH ENDS, TWO NOTCHES NEAR BASE FOR FASTENING HANDLE.

Gilmer County, Georgia.

Division I, Class A. $9 \times 1\frac{7}{8} \times \frac{3}{8}$.

Cat. No. 98028, U.S.N.M.

It may be useless to speculate on these different uses, but the circumstances seem to point toward its use as a knife or dagger.

The danger of fracture of such long, thin flint implements, so easily broken by the shock which would be inevitable in their employment as spears, appears so much against that employment that the author prefers to believe them to have been knives or daggers. Held in the hand, they would give the maximum of service with the minimum of danger from breakage.

Fig. 95.

LEAF-SHAPED IMPLEMENT OF GRAY HORNSTONE, POINTED AT BOTH ENDS.

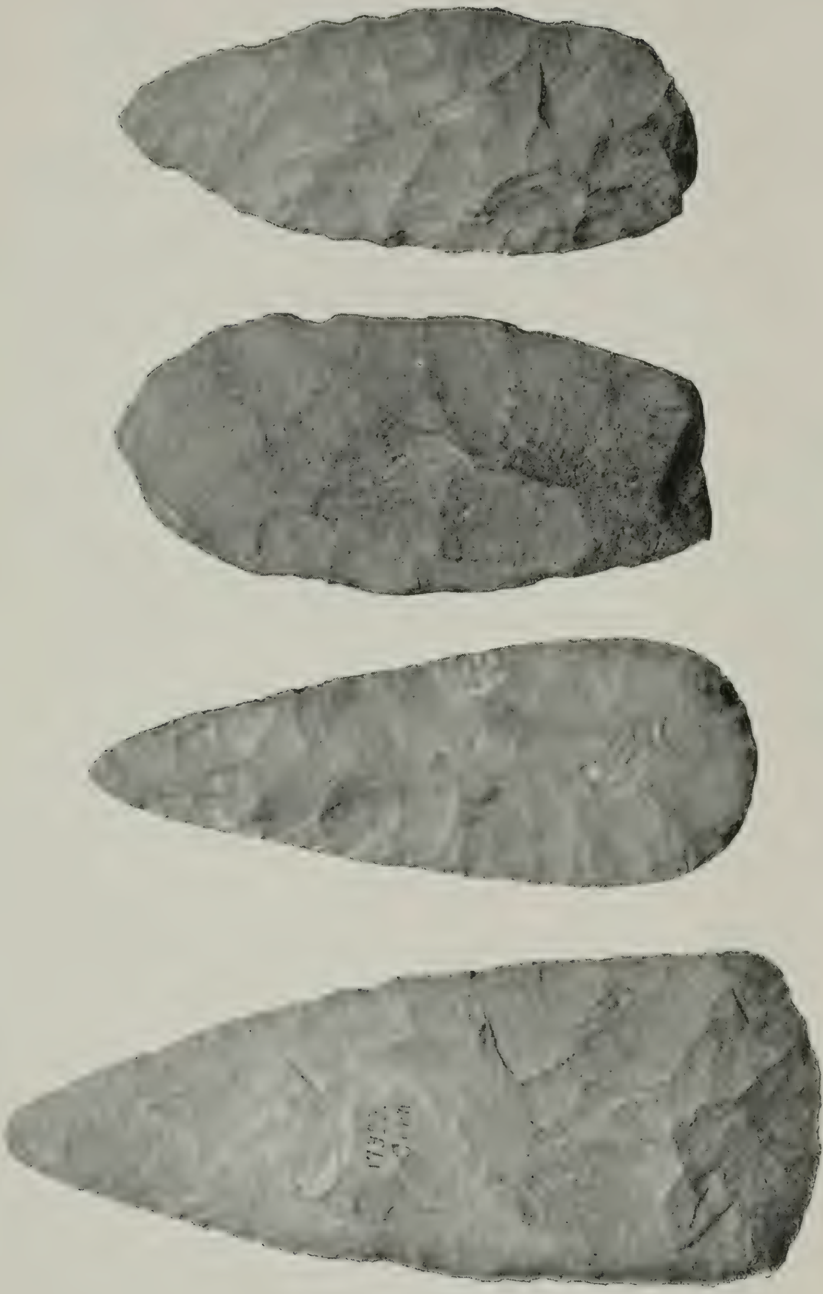
Belleville, St. Clair County, Illinois.

Division I, Class A.

$5 \times 2 \times \frac{5}{16}$.

Cat. No. 32315, U.S.N.M.

Fig. 95 is another of the same type as fig. 94, in that it is a leaf-shaped, Class A, spear point and has the two notches near the base as if for ligatures, which is equally pronounced evidence of it having been intended for a knife or dagger. It is 2 inches wide and but five-sixteenths of an inch thick, so that it would be too fragile for a spearhead. Its edges are convex for the principal portion of the blade, but near the point they become concave, making the edge for the entire length a combination of concave and convex—an ogee. This has the effect of sharpening the point and giving it a needle form. This needle form is extremely rare, this being the only specimen remarked in the U. S. National Museum. The notch in the edges of a leaf-shaped implement pointed at both ends (Class A) is almost equally rare, as the two specimens here shown are the only ones we have. They are introduced not so much because of the rarity of their form as that it may assist in deciding the ultimate destination of the class of leaf-shaped implements to which they belong and which has never been satisfactorily determined. These specimens are from the eastern or middle United States and so have no relation with the long, thin blades from the Pacific coast.



LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class B.

EXPLANATION OF PLATE 29.

LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

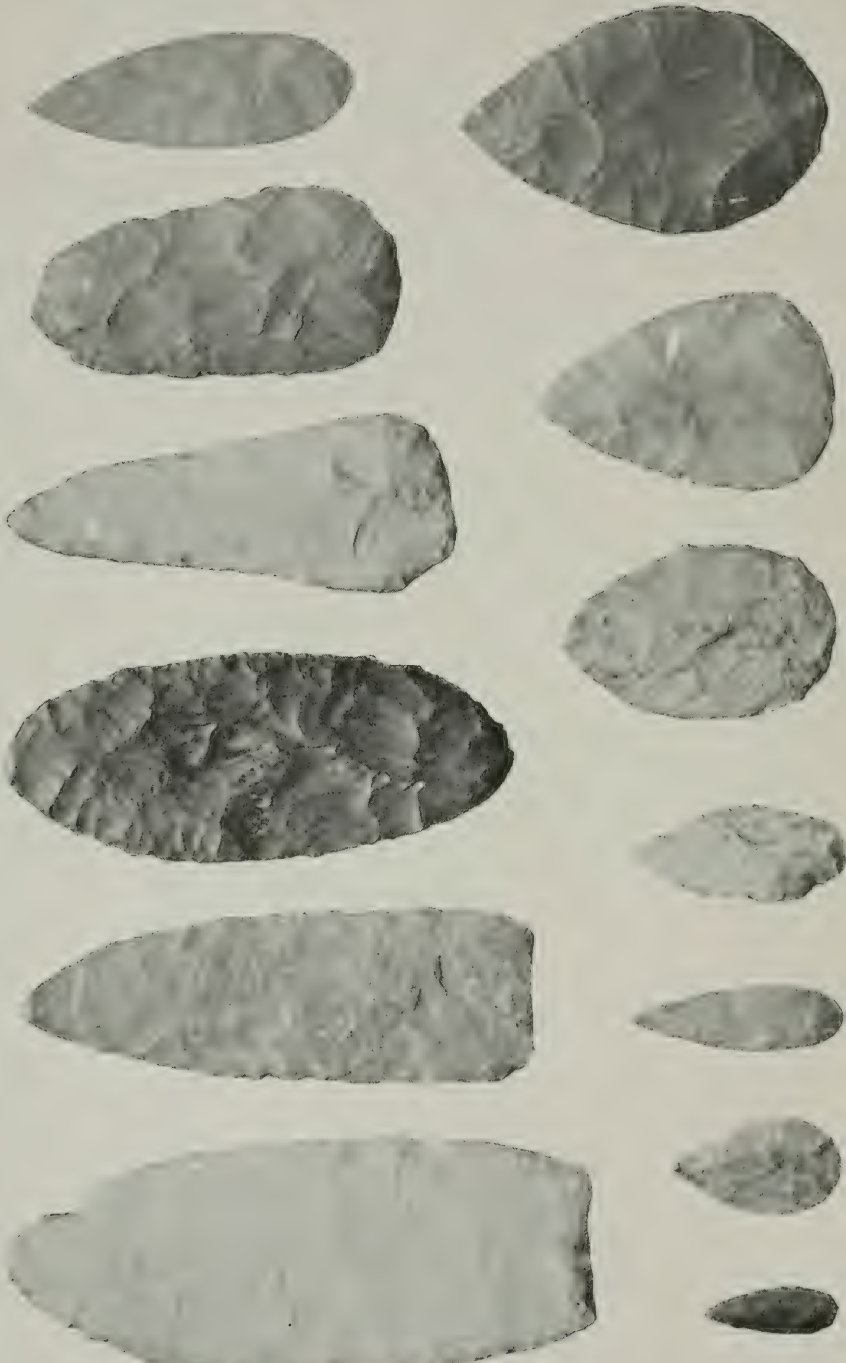
Class B.

Fig. 1. LEAD-COLORED QUARTZ PORPHYRY.
(Cat. No. 17999, U.S.N.M. Daysville, Windham County, Connecticut. J. H. Clark.)

Fig. 2. BLUE GRAY CHALCEDONY.
(Cat. No. 34584, U.S.N.M. Akron, Summit County, Ohio. Thomas Rhodes.)

Fig. 3. ARGILLITE.
(Cat. No. 19365, U.S.N.M. Trenton, New Jersey. Dr. C. C. Abbott.)

Fig. 4. RHYOLITE.
(Cat. No. 35009, U.S.N.M. Catawba County, North Carolina. J. T. Humphreys.)



LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class B.

EXPLANATION OF PLATE 30.

1	2	3	4	5	6
13	12	11	9	8	7

LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class B.

Fig. 1. WHITE CHERT.
(Cat. No. 99312, U.S.N.M. Boone County, Missouri. G. W. Clemens.)

Fig. 2. QUARTZ PORPHYRY.
(Cat. No. 36912, U.S.N.M. Catawba County, North Carolina. J. T. Humphreys.)

Fig. 3. YELLOW JASPER.
(Cat. No. 98438, U.S.N.M. (Chenati Mountains, Presidio. Texas. T. R. Stewart.)

Fig. 4. PINKISH-WHITE FLINTY CHERT.
(Cat. No. 99336, U.S.N.M. Boone County, Missouri. G. W. Clemens.)

Fig. 5. DARK-BROWN FLINTY CHERT.
(Cat. No. 22173, U.S.N.M. Cattaraugus County, New York. Mrs. L. N. Wright.)

Fig. 6. FINE CHERT, COLOR OF BEESWAX.
(Cat. No. 15753, U.S.N.M. San Miguel Island, California. W. G. Harford.)

Fig. 7. BLUISH-BROWN CHERTY FLINT.
(Cat. No, 42960, U.S.N.M. Paxton, Sullivan County, Indiana. J. W. Spencer.)

Fig. 8. GRAY CHALCEDONIC FLINT.
(Cat. No. 8234, U.S.N.M. Ohio. J. H. Devereux.)

Fig. 9. FINE-GRAINED QUARTZITE.
(Cat. No. 8563, U.S.N.M. Mound near Fort Wadsworth, Dakota. Dr. J. A. Comfort, U. S. A.)

Fig. 10. BRILLIANT-WHITE CHALCEDONY.
(Cat. No. 29683*a*, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 11. SHINING-PINKISH CHALCEDONY.
(Cat. No. 29685, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 12. WHITISH-GRAY OPALESCENT QUARTZ.
(Cat. No. 29683*b*, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 13. BLACK BASALT (?).
(Cat. No. 15760, U.S.N.M. San Miguel Island, California. W. G. Harford.)

Figs. 96 to 101, inclusive, are inserted for the purpose of completing the series and are not specially mentioned. The material, size, locality, etc., are given in their accompanying legends.


Fig. 101.


Fig. 96.


Fig. 97.

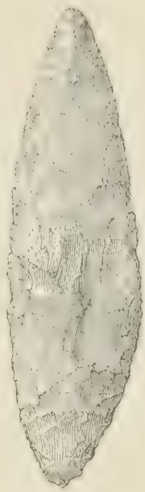


Fig. 98.

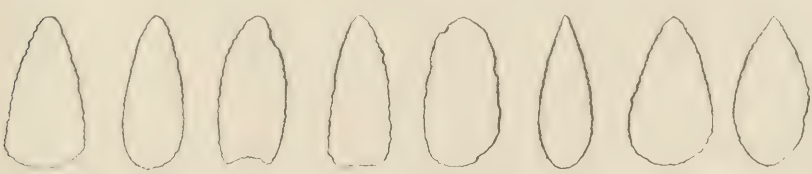

Fig. 99.


Fig. 100.

LEAF-SHAPED ARROWPOINTS, POINTED AT BOTH ENDS. DIVISION I, CLASS A.

Fig. 96.—Obsidian, $4\frac{1}{4} \times 1\frac{1}{3} \times \frac{3}{8}$, Stockton, California. Cat. No. 32363, U.S.N.M.
Fig. 97.—Pale gray flint, $6\frac{3}{4} \times 1\frac{3}{8} \times \frac{5}{16}$, Hardin County, Ohio. Cat. No. 9784, U.S.N.M.
Fig. 98.—Flinty chert, $5\frac{1}{4} \times 1\frac{1}{3} \times \frac{3}{8}$, Oregon. Cat. No. 21743, U.S.N.M.
Fig. 99.—Dark brown jasper, $4\frac{1}{2} \times 2\frac{1}{3} \times \frac{1}{2}$, Trinity, Louisiana. Cat. No. 6633, U.S.N.M.
Fig. 100.—Yellowish brown jasper, $3\frac{5}{8} \times 1 \times \frac{1}{4}$, District of Columbia. Cat. No. 5406, U.S.N.M.
Fig. 101.—Gray flint, $1\frac{3}{4} \times \frac{1}{2} \times \frac{3}{16}$, San Miguel Island, California. Cat. No. 15760, U.S.N.M.

CLASS B.—POINTED AT ONE END; CONCAVE, STRAIGHT, OR CONVEX BASE. (Plates 29, 30.)



These have the same general appearance as Class A. They may be oblong, oval, or ovate, with truncated base, concave, straight, or convex. They are usually larger, and are the commoner form of the leaf-shaped

in the United States. The large argillite specimens from Trenton, New Jersey, found by Dr. C. C. Abbott, belong to this class. These are exceedingly interesting and deserve profound study, as they may prove the connecting link between the Paleolithic and Neolithic periods in the United States. It will be remembered how the leaf-shaped implements were common to both periods. These are of argillite, the material used exclusively for the Trenton implements in the glacial gravels of the Delaware.

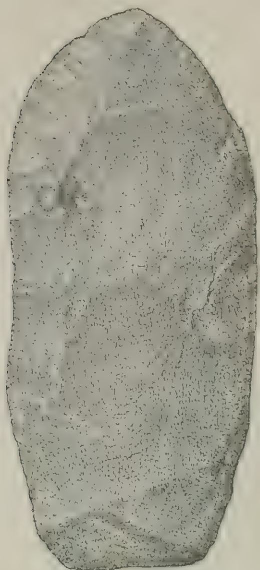


Fig. 102.

LEAF-SHAPED IMPLEMENT OF ARGILLITE, WITH STRAIGHT BASE.

Trenton, New Jersey.

Division I, Class B. $5\frac{3}{8} \times 2\frac{9}{16} \times \frac{3}{8}$.

Cat. No. 19367, U.S.N.M.

Fig. 102 is one of these argillite leaf-shaped implements found by Dr. Abbott at Trenton. Its shape is shown in the illustration. One of these specimens is photographed in the classification, leaf-shaped, Class B (Plate 29, fig. 3). The material seems to have been easily chipped; it could be struck off in broad, thin flakes, shell-shaped, and not long, straight, and narrow as with flint, obsidian, and other chippable materials. Therefore, the chipping appears gross, yet the desideratum of a thin, sharp implement is obtained.

Fig. 103 is another of the same material and from the same locality. The same remark is to be made as to its flakes.

Fig. 103.

LEAF-SHAPED IMPLEMENT OF ARGILLITE, WITH STRAIGHT BASE.

Trenton, New Jersey.

Division I, Class B.

$4\frac{7}{8} \times 2\frac{3}{8} \times \frac{3}{8}$.

Cat. No. 19363, U.S.N.M.

Fig. 104 is from Paxton, Sullivan County, Indiana. Comparison of these three objects will manifest the difference in the chipping of the material. Although the surface of the latter (fig. 104) is much smaller than that of the former, yet the number of flakes struck from it is three times greater. The argillite specimens (figs. 102, 103) have, respectively, but 12 and 13 flakes struck from the broad side; the jaspery flint (fig. 104) has no less than 40. The argillite, contrary to its appearance, is quite hard, and takes and holds a fairly sharp edge; altogether, it was a good material and recommended itself for stone implements.

Figs. 105 and 106 represent specimens of leaf-shaped implements from Ohio. They are of flint, and, while sharp at the point, are so convex at the base as to pass gradually into the disk form so plentiful

in their locality. These formed part of a cache of 201 specimens found in 1872 by S. W. Briggs in Sullivan Township, Ashland County, about 18 inches beneath the surface, deposited in a keg-like vessel of the bark of the red elm, 10 or 12 inches in diameter and 13 inches in height. The specimens average in size from 4 inches long, 2 to $2\frac{3}{4}$ inches wide, and three-eighths of an inch thick.

Fig. 107 is a beautiful specimen, as delicate as though it had been intended for use in a lady's dressing case. It is but one-eighth of an inch thick. It is of dark-gray lustrous flint, with a patina similar to that on the Chelléen implements from the gravels of the rivers Somme and Ouse in Europe.

The late Paul Schumacher found such leaf-shaped points in southern California graves under circumstances which remove all doubts as to their having been the armatures of arrows. He saw, moreover, among the Indians of Oregon, arrows tipped with leaf-shaped flint points. (Rau.)

Fig. 104.
LEAF-SHAPED IMPLEMENT OF PALE GRAY JASPERY FLINT, WITH CONVEX BASE.
Division I, Class B.
$5 \times 1\frac{5}{8} \times \frac{5}{16}$.
Cat. No. 42957, U.S.N.M.

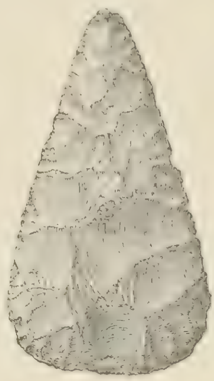


Fig. 105.
LEAF-SHAPED IMPLEMENT OF DARK GRAY FLINT, WITH CONVEX BASE.
Division I, Class B.
$4 \times 2\frac{1}{4} \times \frac{1}{4}$.
Cat. No. 15257, U.S.N.M.

Fig. 106.
LEAF-SHAPED IMPLEMENT OF DARK GRAY FLINT, WITH CONVEX BASE.
Division I, Class B.
$3 \times 2\frac{5}{8} \times \frac{5}{16}$.
Cat. No. 15258, U.S.N.M.

Fig. 108, from Santa Barbara County, California, is a peculiar, long, thin, narrow blade, with a sharp point, and, interesting to remark, its base shows traces of asphaltum or bitumen, by which its shaft or handle was attached. This demonstrates the mode of attachment, but does not aid in the solution whether it was intended for use as a knife or an arrow; that, the shaft or handle alone could determine.

Fig. 109, knife or arrowpoint, is even longer and thinner than the former (fig. 108).

Fig. 110 is of the same general type and from the same general locality. The patina is apparent. Fig. 111 has the same general appearance as fig. 107, but is broader and more oval. Its edges near the point are made concave, so that the point is more delicate and pronounced.

Fig. 112 is a beautiful specimen of translucent chalcedony, and is wrought to a true and even edge by almost infinitesimal flaking. The point and edges one-third way up are smoothed as if by use, not polished, but as though the sharpness of the edge had been worn off. It is a fine specimen.

Fig. 107.

LEAF-SHAPED IMPLEMENT OF DARK GRAY FLINT, WITH CONVEX BASE.

San Miguel Island, California.

Division I, Class B.

$1\frac{3}{4} \times \frac{5}{8} \times \frac{1}{8}$.

Cat. No. 29685, U.S.N.M.

Fig. 108.

LEAF-SHAPED IMPLEMENT OF JASPERY GRAYISH FLINT, WITH CONVEX BASE.

Division I, Class B.

$3 \times \frac{9}{16} \times \frac{3}{16}$.

Cat. No. 20516, U.S.N.M.

Fig. 113 is of porphyritic felsite, which forms so large a portion of the material for prehistoric implements from eastern Massachusetts. Fig. 114 is of reddish quartzite, fine-grained and hard. It is from Rhode Island, and has convex edges and a straight base. Fig. 115 was found at Chattanooga in Tennessee by Messrs. Read and Dayton, but is of the white flint which belongs to Illinois and Missouri, and is a form common to those Western States. It is widest near the base, and from the place of its greatest expansion to the point the edges are straight, and not convex as usual. Fig. 116, from Knox County, Illinois, is of the pale-gray flint with the lustrous chalcedonic appearance common to that State. It is deeply weathered, especially at the two ends, where it is thin. Fig. 117 is elliptical and symmetrical. The edges are smooth and sharp, with fine chipping of long and regular shell-like flakes reaching from the edge to the center ridge. It is a specimen of the most difficult flint chipping in the Museum. There are 48 flakes shown on the two sides. They are one-half to five-eighths of an inch in width and $1\frac{1}{8}$ to $1\frac{1}{4}$ inches in length, and are scarcely thicker than parchment. Such fine work is beyond the skill of any one known to historic times. This specimen was found by Mr. John G. Henderson, of Winchester, Illinois, in a burial mound near Naples, Illinois, associated with numerous curious objects—copper hatchets, elaborate pipes, Pyrula shells, etc.—and is described by him.[1] Fig. 118 is of yellow jasper, of oval form, with con-

Fig. 109.

LEAF-SHAPED IMPLEMENT OF OBSIDIAN, WITH CONVEX BASE.

San Miguel Island, California.

Division I, Class B.

$3\frac{3}{8} \times \frac{9}{16} \times \frac{1}{2}$.

Cat. No. 26426, U.S.N.M.

Fig. 110.

LEAF-SHAPED IMPLEMENT OF LUSTROUS CHALCEDONIC FLINT OR SILICIFIED WOOD, WITH CONVEX BASE.

San Miguel Island, California.

Division I, Class B.

$3\frac{1}{4} \times \frac{7}{8} \times \frac{5}{16}$.

Cat. No. 15734, U.S.N.M.

[1] Smithsonian Report, 1882, p. 696, fig. 11.

vex edges and straight base, more than usual thickness, rude appearance. The large and irregular flaking marks it as something different from the former specimens. Its plane is twisted nearly one-half an inch. There is no evidence of use. Fig. 119 is leaf-shaped, convex but not rounded base, broad in proportion, with convex edges and sharp point.

Fig. 111.

LEAF-SHAPED IMPLEMENT OF PALE GRAY CHALCEDONIC FLINT WITH CONVEX BASE.

San Miguel Island, California.

Division I, Class B.

$1\frac{5}{8} \times \frac{7}{8} \times \frac{1}{4}$.

Cat. No. 29683, U.S.N.M.

Fig. 120 is pale blue, almost white, chalcedonic flint, from Flint Ridge, Licking County, Ohio. The characteristic small quartz crystals are to be seen on its surface. Its base and edges are both convex, as shown in the illustration. The edges all around have been chipped so thin that the light will show through. Dr. Rau has said this was probably a knife, and it may have been, but there is nothing except its comparative width to indicate anything different from any other implement of the same class, and what it might have been is determinable only by the shaft or handle. If it had a long shaft, then this was an arrow or spear; if a short handle, then it was a knife; and as to which it had we know nothing, either by direct or circumstantial evidence. Figs. 121 to 123 are specimens belonging to this class, but have no particular characteristics. They are inserted for the purpose of completing the series. Their material, size, and locality are given at length in their legends.

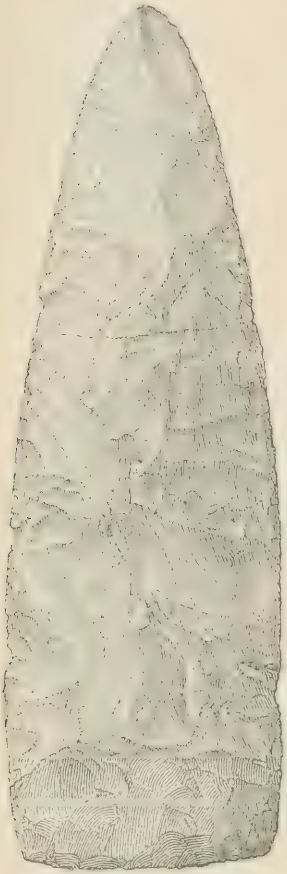


Fig. 112.

LEAF-SHAPED IMPLEMENT OF TRANSLUCENT CHALCEDONY, WITH STRAIGHT BASE.

Tennessee.

Division I, Class B.

$9 \times 3 \times \frac{1}{2}$.

Cat. No. 6501, U.S.N.M.

Fig. 113.

LEAF-SHAPED IMPLEMENT OF PORPHYRITIC FELSITE, WITH CONVEX BASE.

Dartmouth, Bristol County, Massachusetts

Division I, Class B.

$4\frac{1}{2} \times 2 \times \frac{1}{2}$.

Cat. No. 18015, U.S.N.M.

Fig. 114.

Fig. 115.

Fig. 116.

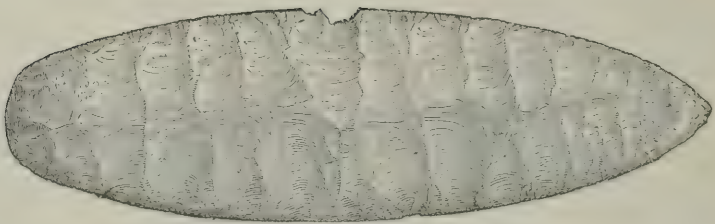


Fig. 117.

Fig. 118.

LEAF-SHAPED IMPLEMENTS. DIVISION I, CLASS B.

Fig. 114.—Straight base. $1\frac{3}{4} \times \frac{3}{4} \times \frac{3}{8}$. Kingston, Rhode Island. Cat. No. 18018, U.S.N.M.

Fig. 115.—White flint, with straight base. $3\frac{3}{4} \times 1\frac{3}{8} \times \frac{5}{8}$. Cat. No. 5947, U.S.N.M.

Fig. 116.—Convex base. $2\frac{3}{8} \times 1\frac{1}{4} \times \frac{1}{4}$. Cat. No. 31987, U.S.N.M.

Fig. 117.—Dark-gray flint, with convex base. $7\frac{3}{8} \times 2\frac{1}{4} \times \frac{3}{8}$. Mound near Naples, Illinois. Cat. No. 43133, U.S.N.M.

Fig. 118.—Straight base. $4\frac{1}{4} \times 2\frac{3}{8} \times \frac{5}{8}$. Piscataway, Maryland. Cat. No. 5833, U.S.N.M.

Fig. 119.

Fig. 120.

Fig. 121.

Fig. 122.

Fig. 123.

LEAF-SHAPED IMPLEMENTS. DIVISION I, CLASS B.

Fig. 119.—Pale-gray chert, with convex base. $2\frac{1}{8}$ x $1\frac{3}{8}$ x $\frac{1}{4}$. Texas. Cat. No. 2404, U.S.N.M.

Fig. 120.—Convex base. $3\frac{1}{4}$ x $1\frac{7}{8}$ x $\frac{1}{4}$. Cat. No. 8234, U.S.N.M.

Fig. 121.—Pale-gray chalcedonic flint, with convex base. $2\frac{3}{4}$ x $1\frac{7}{8}$ x $\frac{1}{4}$. Flint Ridge, Licking County, Ohio. Cat. No. 8234*a*, U.S.N.M.

Fig. 122.—Dark lustrous pyromachic flint, with convex base. $5\frac{1}{8}$ x $2\frac{1}{4}$ x $\frac{3}{8}$. Flint Ridge, Licking County, Ohio. Cat. No. 16461, U.S.N.M.

Fig. 123.—Light-gray flint, with straight base. $2\frac{3}{8}$ x $1\frac{3}{8}$ x $\frac{1}{4}$. Ohio. Cat. No. 11197, U.S.N.M.

CLASS C.—LONG, NARROW BLADES WITH STRAIGHT, PARALLEL EDGES, SHARP POINTS, BASE CONCAVE, STRAIGHT, OR CONVEX. (Plate 31.)

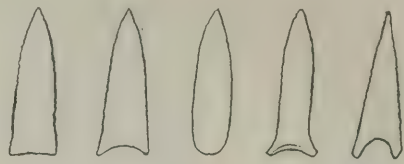


Fig. 124.

NEW CALEDONIAN JAVELIN (MODERN).

Sir John Lubbock, "Prehistoric Times." a, ½ natural size; b, $\frac{1}{6}$ natural size.

This class accommodates the long, narrow blades from the Pacific coast. This variety can be studied in Plate 31, leaf-shaped, Class C. Their sides and edges are straight, and parallel with each other, or nearly so. The convex deflection from a straight line by which the point is formed, may be abrupt or gentle according as the point is made blunt or tapering. The base may be either concave, straight, or convex; there seems to have been no regularity concerning it. In every case it is made by the regular chipping. The specimens vary greatly in length and width, but all are extremely thin, being from one-eighth to three-eighths, never more than one-half inch. The difference between width and length is greater than in any other class. The specimens on the plate show the following extremes: No. 1, $8\frac{3}{4}$ by $1\frac{3}{4}$ by $\frac{5}{16}$ inches; No. 7, 3 by $\frac{7}{8}$ by $\frac{3}{16}$ inches; No. 8, $3\frac{3}{4}$ by $\frac{7}{16}$ by $\frac{3}{16}$ inches; No. 13, $1\frac{7}{8}$ by $\frac{1}{2}$ by $\frac{1}{8}$ inches.

Fig. 125.

LEAF-SHAPED IMPLEMENT OF BROWNISH-GRAY JASPER, WITH CONCAVE BASE AND PARALLEL EDGES.

Santa Barbara County, California.

Division I, Class C.

$8\frac{3}{4}$ x $1\frac{3}{4}$ x $\frac{3}{8}$.

Cat. No. 21632, U.S.N.M.

The materials of the implements of this class are agate, chalcedony, flint in its purer condition, obsidian, and similar fine material. These materials are susceptible of delicate chipping, and the prehistoric workmen have employed their opportunity with the result of elegant and beautiful specimens. The usual remark is to be made as to their

EXPLANATION OF PLATE 31.

1	2	3	4	5	6	7
	13	12	11	10	9	8

LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class C, Pacific Coast.

Fig. 1. OPALESCENT CHERT.
(Cat. No. 21632, U.S.N.M. Santa Barbara County, California. Paul Schumacher.,

Fig. 2. OPALESCENT CHERT.
(Cat. No. 62484, U.S.N.M. Dos Pueblos, Santa Barbara County, California. Capt. G. M. Wheeler, U. S. Geological Survey.)

Fig. 3. PINKISH SLATE.
(Cat. No. 8927, U.S.N.M. West Derby, Vermont. H. W. Norris.)

Fig. 4. BLACK CHALCEDONY.
(Cat. No. 62481, U.S.N.M. Dos Pueblos, Santa Barbara County, California. Capt. G. M. Wheeler.)

Fig. 5. OBSIDIAN.
(Cat. No. 25424, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 6. GRAY CHALCEDONY.
(Cat. No. 171441, U.S.N.M. Burke County, Georgia. Dr. R. Steiner.)

Fig. 7. BROWNISH FLINT.
(Cat. No. 171441, U.S.N.M. Burke County, Georgia. Dr. R. Steiner.)

Fig. 8. WHITE CHERT.
(Cat. No. 23674, U.S.N.M. Santa Rosa Island, California. Stephen Bowers.)

Fig. 9. BLACK FLINTY CHALCEDONY. Bitumen on stem, evidence of a handle.
(Cat. No. 26426, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 10. YELLOWISH FLINT.
(Cat. No. 171441, U.S.N.M. Burke County, Georgia, Dr. R. Steiner.)

Figs. 11. GRAYISH FLINT.
(Cat. Nos. 20516, U.S.N.M. Santa Barbara County, California. Paul Schumacher.)

Fig. 12. GRAYISH FLINT.
(Cat. No. 26415, U.S.N.M. San Miguel Island. Stephen Bowers.)

Fig. 13. GRAYISH FLINT.
(Cat. No. 15761, U.S.N.M. Santa Barbara County, California. Paul Schumacher.)

LEAF-SHAPED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class C.

Pacific coast.

having been used as arrowpoints, spearheads, or knives. Many of them are so wrought that they could not have been held in the hand unprotected. For example, those with sharp corners made by the concave or square bases would be needless if the implements were to be without a handle. That they were used with handles is proved by the asphaltum or bitumen still adhering to the base for a perceptible distance up the blade, as shown in figs. 107 and 130. This evidence of handling is not confined to one size or kind of these implements, nor to one locality. Fig. 108 is but $3\frac{3}{4}$ inches long

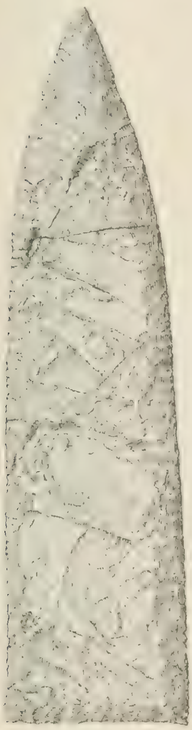


Fig. 126.

LEAF-SHAPED IMPLEMENT OF GRAY FLINT OR JASPER, WITH STRAIGHT BASE AND PARALLEL EDGES.

Santa Barbara County, California.

Division I, Class C.

$7\frac{1}{4}$ x 2 x $\frac{1}{4}$.

Cat. No. 21631, U.S.N.M.

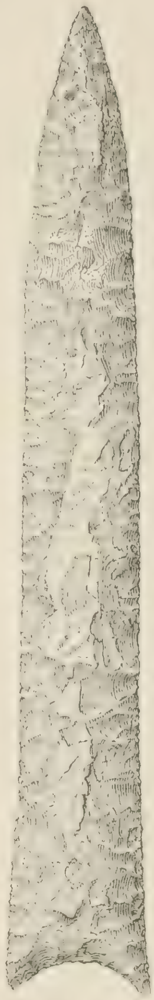


Fig. 127.

LEAF-SHAPED IMPLEMENT, WITH CONCAVE BASE AND PARALLEL EDGES.

California.

Division I, Class C.

$10\frac{1}{2}$ x $1\frac{1}{4}$ x $\frac{1}{4}$.

Cat. No. 21626, U.S.N.M.

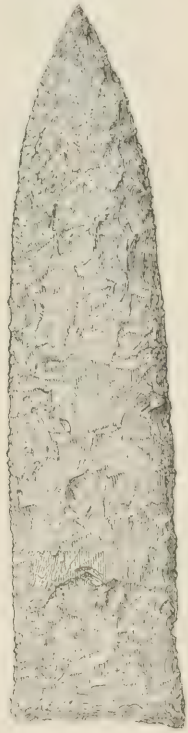


Fig. 128.

LEAF-SHAPED IMPLEMENT OF LUSTROUS FLINT OR CHALCEDONY, WITH SLIGHTLY CONCAVE BASE AND PARALLEL EDGES.

California.

Division I, Class C.

Cat. No. 62484, U.S.N.M.

and seven-sixteenths of an inch wide, while fig. 130 measures 10 by $1\frac{1}{4}$ by three-eighths inches. In the chapter on knives we will revert to these specimens and show them with their handles attached with bitumen.

Fig. 124, a specimen of modern spear of obsidian flakes from New Caledonia, attached to a thin handle or shaft by means of gum, bitumen, or asphalt, and, taken from Sir John Lubbock's Prehistoric Times, is inserted for comparison.

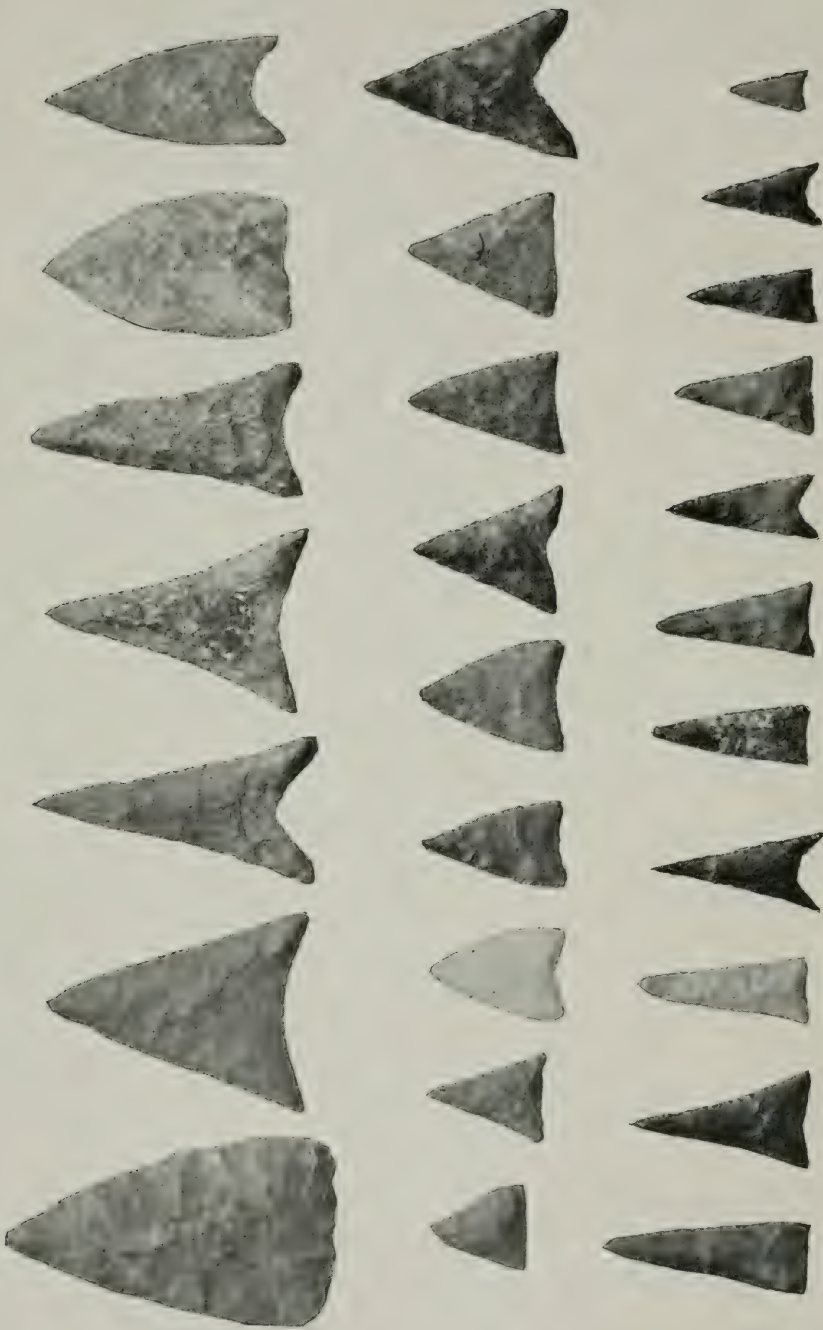
Fig. 129.
LEAF-SHAPED IMPLEMENT OF LUSTROUS FLINT OR CHALCEDONY, WITH CONCAVE BASE AND PARALLEL EDGES.
California.
Division I, Class C.
$5\frac{3}{4} \times 2 \times \frac{5}{16}$.
Cat. No. 21628, U.S.N.M.

Fig. 125 is an extremely thin, finely chipped object, from Santa Barbara County, California, and is a sample of those from the Pacific coast. We are to remark the long, narrow blade, the parallel edges, the fine material, the delicate chipping, and the extreme thinness as peculiarities of these implements from this locality. The specimens on Plate 31 will serve as further illustrations.

Fig. 126 is another of the long, narrow, and thin flint or jasper implements from the Pacific coast. Although it is $7\frac{3}{8}$ inches long and 2 inches wide, it is but one-eighth of an inch thick. It, with two or three other specimens, is peculiar in that, though thin, they have not been reduced by chipping. They are quite flat in section, reduced in thickness only to form the edge. This peculiarity is caused by the layer of flint being of natural formation in its present thickness. The deposit of flint, however made, has been intercalated with a layer on each side of what has the appearance of lime or chalk, the surface being broken by right lines into parallelogramic figures, as shown in the illustration. Only slight chipping was necessary to reduce the implement to a sharp edge. For the better understanding of this, reference is made to Plate 31, fig. 2.

Fig. 130.
LEAF-SHAPED IMPLEMENT OF BLACK FLINT, WITH CONCAVE BASE AND PARALLEL EDGES.
California.
Division I, Class C.
$10 \times 1\frac{1}{4} \times \frac{3}{8}$.
Cat. No. 62483, U.S.N.M.

Fig. 127 is the longest, thinnest, and narrowest of these leaf-shaped objects from the Pacific coast. Its edges are parallel for nearly the entire length. It is slightly thicker nearer the base, which is strongly concave. It is of gray flint or jasper, and has been deposited in the strata mentioned in the description of fig. 126, of which traces are shown in the illustration. The edges have been wrought by chipping, and they, with the point and barbs, are fine and sharp.



TRIANGULAR ARROWPOINTS, SPEARHEADS, OR KNIVES.

EXPLANATION OF PLATE 32.

1	2	3	4	5	6	7				
16	15	14	13	12	11	10	9	8		
17	18	19	20	21	22	23	24	25	26	27

Triangular Arrowpoints, Spearheads, or Knives.

Fig. 1. Green Chalcedony.
(Cat. No. 18048. U.S.N.M. Westerly, Washington County, Rhode Island. J. H. Clark.)

Fig. 2. Greenish Flint.
(Cat. No. 18057, U.S.N.M. Cumberland, Providence County, Rhode Island. J. H. Clark.)

Fig. 3. Yellow Flint.
(Cat. No. 171438, U.S.N.M. Waynesboro, Burke County, Georgia. Dr. R. Steiner.)

Fig. 4. Gray Flint.
(Cat. No. 6177, U.S.N.M. Stillwater, Washington County, New York. Col. E. Jewett.)

Fig. 5. Blue-black Flint.
(Cat. No. 171438*a*, U.S.N.M. Waynesboro, Georgia. Dr. Roland Steiner.)

Fig. 6. Light-Gray Flint.
(Cat. No. 11107, U.S.N.M. Milnersville, Guernsey County, Ohio. D. T. Thompson.)

Figs. 7, 8. Yellow Flint.
(Cat. Nos. 171438*b*, 171438*c*, U.S.N.M. Waynesboro, Georgia. Dr. Roland Steiner.)

Fig. 9. Porphyritic Felsite.
(Cat. No. 18060, U.S.N.M. Nantucket Island, Massachusetts. J. H. Clark.)

Fig. 10. Fine-grained Quartzite.
(Cat. No. 18034, U.S.N.M. Chilmark, Dukes County, Massachusetts. J. H. Clark.

Fig. 11. Dark-Gray Flint.
(Cat. No. 31587, U.S.N.M. Bainbridge, York County, Pennsylvania. F. G. Gailbraith.)

Fig. 12. Quartz Porphyry.
(Cat. No. 18021, U.S.N.M. Wickford, Washington County, Rhode Island. J. H. Clark.)

Fig. 13. Light-Brown Flint.
(Cat. No. 10004, U.S.N.M. Camden County, Georgia. Gen. C. R. Floyd.)

Fig. 14. White Quartz.
(Cat. No. 18033, U.S.N.M. Essex, Middlesex County, Connecticut. J. H. Clark.)

Fig. 15. Dark-Gray Flint.
(Cat. No. 113819, U.S.N.M. Kanawha County, West Virginia. Bureau of Ethnology. P. W. Norris.)

Fig. 16. Dark-Gray Flint.
(Cat. No. 18031, U.S.N.M. East Haddon, Middlesex County, Connecticut. J. H. Clark.)

Fig. 17. Gray Chert.
(Cat. No. 22175, U.S.N.M Sheridan, Chautauqua County, New York. N. Gould.)

Fig. 18. Black Flint.
(Cat. No. 18086, U.S.N.M. Mound in Ohio. J. H. Clark.)

Fig. 19. White Flint.
(Cat. No. 21921, U.S.N.M. Waukegan, Lake County, Illinois. J. W. Milner.)

Fig. 20. Dark-Brown Jasper.
(Cat. No. 12744, U.S.N.M. Oregon. Paul Schumacher.)

Fig. 21. Black Flint.
(Cat. No. 5315, U.S.N.M. Llano County, Texas. A. R. Roessler.)

Fig. 22. Greenish Flint.
(Cat. No. 32239, U.S.N.M. Catawba County, North Carolina. J. T. Humphrey.)

Fig. 23. Variegated Flint, Brown and Gray.
(Cat. No. 29683, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 24. Gray Flint.
(Cat. No. 16471, U.S.N.M. Southern Ohio. Dr. C. A. Miller.)

Fig. 25. Dark Flint.
(Cat. No. 29961, U.S.N.M. Louisburg, Franklin County, North Carolina. F. G. Foster.)

Fig. 26. Brown Jasper.
(Cat. No. 20275, U.S.N.M. Oregon. Paul Schumacher.)

Fig. 27. White Chert.
(Cat. No. 136959, U. S. N. M. Labette County, Kansas. W. S. Hill.)

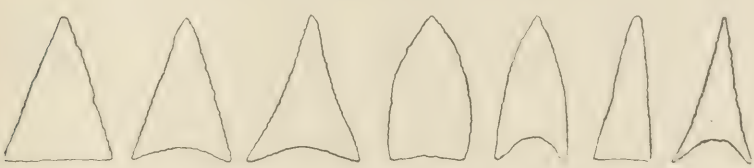
Figs. 128 and 129 (see Plate 31, fig. 2) belong to the same class. They are from the same locality, Santa Barbara County, California, and evidently the same material, which is stratified flint or chalcedony, lustrous, having the appearance of a brilliant patina. The edges are parallel and the bases slightly concave.

We now pass to an implement having sufficient resemblance to require its placement in Class C, and although from the same locality as the foregoing implement, it has such a difference of material, workmanship, and apparently of service, that its manufacture and use may have been separated from them by long time or distance or perhaps both. Two specimens of this kind are here shown (figs. 130, 131). They are from Dos Pueblos, Santa Barbara County, California, are of black flint, and bear traces (especially the larger, fig. 130) of bitumen having served as an attachment for a handle. (See p. 906 and fig. 124.)

Fig. 130 represents an implement, 10 inches long and $1\frac{1}{4}$ inches wide, its edges being perfectly straight and parallel for $7\frac{1}{2}$ inches of the length, and of exquisite workmanship. Fig. 131, though not so large is equally as fine (Plate 31, fig. 4). The edges and points are smooth and sharp. The chipping by which they have been reduced has been fine, with small and delicate flakes running from the edge to the center ridge. An inspection of the illustrations will show the beauty of the work. Both specimens bear traces of the bitumen by which the shaft or handle was fastened.

Fig. 131.
LEAF-SHAPED IMPLEMENT OF BLACK FLINT, WITH CONVEX BASE AND PARALLEL EDGES.
California.
Division I, Class C.
$7 \times 1\frac{1}{4} \times \frac{1}{4}$.
Cat. No. 62481, U.S.N.M.

DIVISION II—TRIANGULAR. (Plate 32.)



This division includes all arrowpoints or spearheads in the form of a triangle, whether the bases or edges be straight, convex, or concave. It might be that the concavity or convexity of the lines of the edges would, in strict geometrical nomenclature, exclude this from being called a triangle, but the author ignores this criticism and has kept the name given by many others and understood by all.

This class includes all kinds of triangles, whether equilateral or isosceles, and whatever may be the relation of length between the

lines of base and edge. The edges may be convex or concave and the base with an exaggerated concavity, the two corners forming barbs, the arrow shaft the stem (Plate 32, figs. 3, 8, 20, 23, 26). Some of these implements are extremely rude, especially those of quartz and of jasper, which are refractory material, but many of these have been delicately and finely chipped.

Triangular arrowpoints, while found in great profusion in some localities, are not nearly so numerous throughout the country as other divisions. They appear in greater numbers on the Atlantic coast than in the interior. Dr. Abbott says that in a series of 3,300 arrowpoints from Mercer County, New Jersey, 1,428 were triangular. Although this may be the simplest form of arrowpoint, yet the author doubts if that be evidence of its having had any precedence in manufacture, or that there was any evolution from it to other forms. That there may have been relationship is granted. The arrow maker may have made indifferently the triangular and leaf-shaped, and he may have changed from one to the other, dependent upon the peculiarities of the material and the success with which he was able to work it, and the question of fashion and custom can not be ignored. It is thought these reasons are sufficient to account for the infinite variety of shape in arrowpoints.

The author has laid down no hard and fast lines of division in this classification. Some of the leaf-shaped may have had their bases and edges straightened (Plate 30, fig. 8), and the triangular had their corners rounded until the two divisions came together (Plate 32, figs. 1, 6); so also with the leaf-shaped and the stemmed. Some of the former have been notched near the base and thus been changed to stemmed, and so on through the entire system. This classification is made for the student and for convenience of description; therefore there will be overlapping of the dividing lines between the classes, as will be readily seen by referring to Plate 32. This must be accepted unless we would make infinitesimal divisions and every slight difference in form make a separate class. So each division includes all forms which approach nearest to it, even if they have peculiarities which make it difficult to harmonize. Some of the peculiarities in the triangular division are to be noted. One is where the convexity of the edges continued to the base brings a close resemblance to Division I, leaf-shaped, Class B, (Plate 30, figs. 1, 6). Another is the widening just at the base, by which the implement takes on a slight bell shape (Plate 31, fig. 10); another is where the edges of the triangle do not come in a straight line nor yet in a curved line from the point to the base, but make an angle midway between the two and give the implement a pentagonal form rather than strictly triangular (fig. 178). A few of the triangular forms have serrated or beveled edges, though this is rare. Occasionally the barbs on one side are longer than the other. There is no rule for the concavity of the base; it varies from almost a straight line to a depth equal to one-third of the length of the implement.

Dr. Rau, in the paper already mentioned, gave expression to the possibility of the triangular implement not having been an arrowpoint, but that the point may have been intended for insertion in a handle, and the base, being sharp, intended for a cutting implement and to be used for a chisel. (See p. 887.)

Fig. 132.

TRIANGULAR, EQUILATERAL ARROWPOINT.

Nantucket Island, Massachusetts.

Division II.

$1\frac{1}{2}$ x $1\frac{1}{4}$ x [illegible].

Cat. No. 18060, U.S.N.M.

(18057)

Fig. 133.

TRIANGULAR ARROWPOINT OR SPEARHEAD, WITH STRAIGHT EDGES AND CONCAVE BASE.

Rhode Island.

Division II.

$2\frac{1}{2}$ x $1\frac{15}{16}$ x $\frac{3}{16}$.

Cat. No. 18057, U.S.N.M.

However, the author does not subscribe to this opinion nor adopt the theory. He believes these were, of all others, plain, simple arrowpoints and never intended for anything else, except, possibly, that the heavier ones might have been attached to longer shafts and used as javelins. This would be practically the same use as an arrowpoint, and no one, not finding the shaft or knowing its size or length, could know from any inspection of the implement this difference in its use. He does not think it could have been used as a chisel, for none of them that he has ever seen show any marks of use at the base. The greater proportion of them, as has been said, have concave bases, and especially is this true of those with sharp edges. A chisel with a concave base is unknown in our study of prehistoric man, and one can scarcely suggest the necessity for an implement possessing this peculiarity, whether its use be by the Indian or the white man, historic or prehistoric. If thus used as a chisel, that which is now regarded as the point becomes the stem and is to be inserted into its handle; this would make a broad-ended chisel with a concave edge. A cutting edge of such width would give great purchase as against the handle, and if one should attempt to use these outside edges or corners after the manner of a chisel, the implement would be in danger of breaking out of its handle, or, if this was avoided, would require a stronger fastening than we could imagine that it ever received at the hands of the Indian. No handle fastened with a thong, sinew, cord, or even bitumen would ever be able to hold this implement handled in this way when used

(6177)

Fig. 134.

TRIANGULAR ARROWPOINT OF GRAY FLINT, WITH CONCAVE EDGES AND BASE.

Stillwater, Washington County, New York.

Division II.

$2\frac{1}{2}$ x $1\frac{7}{8}$ x $\frac{3}{16}$.

Cat. No. 6177, U.S.N.M.

Fig. 135.

TRIANGULAR ARROWPOINT, WITH CONCAVE BASE.

Chilmark, Massachusetts.

Division II.

$1\frac{1}{4}$ x 1 x $\frac{3}{16}$.

Cat. No. 18045, U.S.N.M.

as a chisel. One has but to look at the modern chisel with its long steel tang well fitted and driven hard into a solid oak handle with a collar to receive the bottom of the handle, making the entire implement as firm in its handle as though it was all one piece. Watch the mechanic as he uses his chisel, strong and well-handled as it is, and see the purchase it has when used on the corners, and anyone will shortly understand the impossibility of the ancient handling being strong enough to stand this use. The same objection applies with equal force against the use of the implement as a knife, even when handled at the base as is the arrow. It would inevitably twist and slip and become loose in its handle, and so worthless. The author has, throughout this paper, contented himself with stating facts and has not advanced theories of his own nor argued those of others; but in the present case he thinks a consideration of the situation and an investigation of the surroundings will show that these implements were not used on their edges as cutting or sawing implements, either as chisels or knives, but solely for thrusting or striking with the point as arrows; but whether as arrows they were weapons of war or javelins for game he has no opinion, and no amount of examination of the object itself serves to elucidate the theory.

Fig. 136.

TRIANGULAR ARROWPOINT, DEEPLY CONCAVE.

Oregon.

Division II.

$1\frac{3}{4} \times \frac{3}{4} \times \frac{1}{8}$.

Cat. No. 12744, U.S.N.M.

(8233)

Fig. 137.

TRIANGULAR ARROWPOINT OF WHITE QUARTZ.

Division II.

$2\frac{1}{2} \times 2 \times \frac{1}{2}$.

Cat. No. 8233, U.S.N.M.

Fig. 138.

TRIANGULAR ARROWPOINT OF PALE GRAY FLINT, WITH CONVEX BASE.

St. George, Washington County, Utah.

Division II.

$4\frac{1}{4} \times 1\frac{7}{8} \times \frac{1}{8}$.

Cat. No. 20991, U.S.N.M.

Fig. 132 is almost an equilateral triangle. It is of the porphyritic felsite common to eastern Massachusetts, and is thick, heavy, and rudely made. Its point is sharp, but not the barbs. It is a good representation of the average and usual size and appearance of the triangular arrowpoint.

Fig. 133 is one of the larger triangular arrowpoints or spearheads. It is of dark-gray flint, almost black. Its edges are straight and its base concave, symmetrical from every view, delicately chipped to regular and smooth point, edges, barbs, and base.

Fig. 134 is quite thin, delicately chipped, showing very small serrations. The edges and base are concave. The points and barbs are fine and sharp. Fig. 135 is of white quartz, and for this material well and regularly chipped. It is quite symmetrical,

with sharp, smooth point and edges. These appear mostly on the Atlantic coast.

Fig. 136 is one of those elegant and minute arrowpoints which have made Oregon renowned in the world of archæology. It is dark-brown jasper, is triangular in form, with long, tapering point. Its edges are very slightly concave, but the base is so deeply concave that the corners form long, slender barbs. Other specimens from the same locality have notches on the edges near the base, by means of which the sinew or cord fastens the head to its shaft, but this, and indeed none of the triangulars, have any such contrivance.

Fig. 137 is one of the triangular forms from Massachusetts. It is rude and irregular on edges and base.

Fig. 138, although with an elongated point, yet is to be classed as triangular. It is a marvel of flint chipping. Four and a quarter inches long and 1¾ inches wide, it is nowhere more than one-eighth of an inch in thickness. This is as thin as any specimen can be expected. The base of this specimen is slightly convex; the edges are nearly straight. They and the point are fine and sharp.

Some of the specimens from the Pacific coast, figured in leaf-shaped, Class C, are as thin as this, but, as described, this was their natural thickness. They were separated from each other by a deposit of extraneous matter. This specimen is not of such formation. It has been wrought out of a solid block of flint, and was effected by those broad and thin flakes so often found, running from the edge, the point of pressure, to the center, widening into the form of a shell, and reducing the thickness of the implement almost as much at the center as at the edge. This system is the perfection of flint chipping. It shows a high degree of manual dexterity, and is one of the lost arts, for no workman known in historic times has been able to reproduce it.

DIVISION III—STEMMED.

The author has not made this class dependent upon the lines of the edges or bases of these implements; they may be either convex, straight, or concave, and neither of these will have any effect as to which class the implement is to be assigned. He has considered that it made but slight difference to the primitive hunter or warrior when about to use one of these implements, either as an arrowpoint, spearhead, or as a knife, whether it should be convex, straight, or concave, provided the point was sharp and the cutting edge keen and smooth. If to be used for piercing, the desideratum was a sharp point, the shape of the edge had no effect and was of no interest, and if as a knife and the edges to be used saw fashion, back and forth, it made little difference whether that edge should be concave, straight, or convex. As all stemmed implements presuppose a handle or shaft which incloses the stem, it makes equally slight difference whether the base of that stem should be concave, straight, or convex; there-

fore the author has not allowed any of these distinctions to influence his classification.

That these different classes and the forms on which they depend should overlap and run into one another would seem inevitable, thus making it sometimes doubtful to which class the implement should belong, and even difficult to decide correctly. The classification which is proposed, and indeed any classification which can be made is, as before stated, rather for the convenience of the modern student than from any intention of the primitive maker or user of these implements. While there may have been workshops which turned out certain forms of implements more than others, and while certain forms are found in given localities in greater numbers than in others, yet does not think that this was always the result of a well-defined intention on the part of the maker. If an arrowpoint, intended to have a convex edge, should by an unlucky stroke or an unintentional break be spoilt for that shape, it could still be remodeled and the edge made straight instead of convex, or concave instead of straight. So, also, that which was intended as a barbed arrowpoint, if one of the barbs should be broken, the barb on the other side could also be chipped off and the implement be made shouldered, but not barbed; and so on in other instances.

The author has bethought of what he considers a good illustration of the differences in these implements. In the show window of a modern shoe store will be seen shoes of every imaginable shape, size, kind, and variety; no two pairs of them are alike, running the entire range from large to small, from coarse to fine, from high to low, from thick to thin, from costly to cheap; yet they are all shoes, and all intended for the same object of foot wear. The workmen may all make the same kind of shoes or make different kinds at different times, yet they surely are all shoemakers. So it was with the arrow makers and the arrowpoints which they made; the difference in the arrowpoints may have been produced partly by the fashion of the locality, by the taste and ability of the workmen, or by the possibilities of the material; what may have been intended for one kind of arrowpoint may, by reason of the refractory material, have been changed to another, and the same workmen in the same workshop may, without having seriously intended, and perhaps without giving a good reason in every case, have produced nearly every kind of arrowpoint.

If the author made a separate class for every change in detail, he would have an infinite number of classes with infinitesimal differences. He has preferred to ignore these, make his divisions broad and plain, and temporize with the overlapping forms.

STEMMED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class A.

EXPLANATION OF PLATE 33.

1	2	3	4	5	6	7
14	13	12	11	10	9	8

Stemmed Arrowpoints, Spearheads, or Knives.

Class A.

Fig. 1. Quartzite.
(Cat. No. 34247, U.S.N.M. Truro, Barnstable County, Massachusetts. A. R. Crittenden.)

Fig. 2. Porphyry.
(Cat. No. 61428, U.S.N.M. La Paz, Lower California. L. Belding.)

Fig. 3. Quartz Porphyry.
(Cat. No. 18100, U.S.N.M. Rhode Island (from a cache of 100 similar objects. J. H. Clark.)

Fig. 4. Black Quartz Porphyry.
(Cat. No. 32183, U.S.N.M. Keeseville, Essex County, New York. A. W. White.)

Fig. 5. Mottled Brown Obsidian.
(Cat. No. 21372, U.S.N.M. Hupa Indian Reservation. Stephen Bowers.)

Fig. 6. Quartzite.
(Cat. No. 6111, U.S.N.M. District of Columbia. Mrs. M. H. Schoolcraft.)

Fig. 7. Chalcedony.
(Cat. No. 34417, U.S.N.M. Plantersville, Morehouse County, Iowa. Dr. B. H. Brodnax.)

Fig. 8. Argillite.
(Cat. No. 19371, U.S.N.M. Trenton, New Jersey. Dr. C. C. Abbott.)

Fig. 9. White Quartz.
(Cat. No. 19008, U.S.N.M. Griffin, Spaulding County, Georgia. W. F. Bailey.)

Fig. 10. Brown Jasper.
(Cat. No. 34861, U.S.N.M. Island in Susquehannah River. F. G. Gailbraith.)

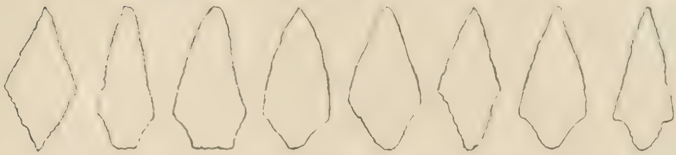
Fig. 11. Opalescent Chalcedony.
(Cat. No. 29683, U.S.N.M. San Miguel Island, California. Stephen Bowers.)

Fig. 12. White Quartz.
(Cat. No. 6443, U.S.N.M. Farmingdale, Queens County, New York. J. C. Merritt.)

Fig. 13. Quartzite.
(Cat. No. 1275, U.S.N.M. Farmingdale, Queens County, New York. J. C. Merritt.)

Fig. 14. White Quartz.
(Cat. No. 139271, U.S.N.M. District of Columbia. S. V. Proudfit.)

CLASS A.—LOZENGE-SHAPED. (Plate 33.)



These implements are usually small. They are the simplest in form and, for the most part, rudest in execution; yet this is no signification that they were the beginnings or that there was an evolution from this to the more elaborate forms. This simplicity and rudeness may be accounted for in divers ways. The refractory material may have had something to do with it, also the rapidity with which they were required to be made and the unskillfulness of the arrow maker. They may have been made during his apprenticeship; he, who in his beginning made these simplest and rudest implements may have so acquired the art as afterwards to make the finest and most delicate.

Fig. 139.

STEMMED ARROWPOINT OF PORPHYRITIC FELSITE, LOZENGE-SHAPED.

La Paz, Lower California.

Division III, Class A.

$4 \times 2\frac{1}{3} \times \frac{3}{8}$.

Cat. No. 61428, U.S.N.M.

These form Class A, the first of the division of stemmed arrowpoints. The existence of a stem implies its insertion in a shaft or handle; therefore there can be little or no doubt that these were intended to be thus used.

Fig. 140.

STEMMED ARROWPOINT OF PORPHYRITIC FELSITE, LOZENGE-SHAPED.

Edgartown, Dukes County, Massachusetts.

Division III, Class A.

$2\frac{3}{4} \times 1\frac{1}{8} \times \frac{3}{8}$.

Cat. No. 18103, U.S.N.M.

Fig. 139 is one of the largest, as it is one of the best in workmanship, of its class in the U. S. National Museum. It is of porphyritic material, and comes from Lower California, therefore it affords no standard of comparison; for the types of implements in that country are different from those in other parts of the United States. It is lozenge-shaped, is so regularly pointed at both ends that it is uncertain which end was point and which was base.

Fig. 141.

STEMMED ARROWPOINT OF WHITE QUARTZ, LOZENGE-SHAPED.

Division III, Class A.

$1\frac{11}{16} \times \frac{3}{4} \times \frac{5}{16}$.

Cat. No. 5897, U.S.N.M.

Fig. 140 comes from Massachusetts, is similar in form, with its sharp point and base, and, curiously enough, is also of porphyritic material. These sharp-pointed bases of the class are unusual, if not rare, in any part of the United States. The more usual form of lozenge shape is shown in fig. 141, which is of quartz, and comes from Charles County, Maryland. The refractory character of this material may account largely for the predominance of this simple form and rude style of arrowpoint. It is

inordinately thick compared with its width. It is three-fourths of an inch wide and five-sixteenths thick, nearly one-half. The leaf-shaped implements which have been described were five or six times greater in width than thickness.

Fig. 142.

STEMMED ARROW-POINT, LOZENGE-SHAPED.

East Windsor, Hartford County, Connecticut.

Division III, Class A.

$1\frac{1}{2} \times \frac{3}{4} \times \frac{1}{4}$.

Cat. No. 6084, U.S.N.M.

The lozenge-shaped arrowhead with a rude but pointed stem without shoulders would appear impossible to fasten firmly in an arrow shaft by means of ligatures, which suggests that some kind of gum or adhesive substance was used to make it fast, though the author does not know that any such specimen has been found showing traces of gum. Because of the great size and rudeness of the base of some of these implements, they may have been too large to receive the small arrow shaft and so may have required comparatively large and heavy handles. Thus, despite their small size as a class, they may have served as spears or possibly knives—who knows? This is purely conjecture, based upon the appearance of the implement itself, and is liable to be overturned by the discovery of any new fact concerning it.

Fig. 143.

STEMMED ARROW-POINT, LOZENGE-SHAPED.

Keeseville, Essex County, New York.

Division III, Class A.

$3\frac{1}{2} \times 1\frac{3}{16} \times \frac{5}{16}$.

Cat. No. 32183, U.S.N.M.

Fig. 144.

STEMMED ARROW-POINT OF PALE GRAY FLINT, LOZENGE-SHAPED.

Division III, Class A.

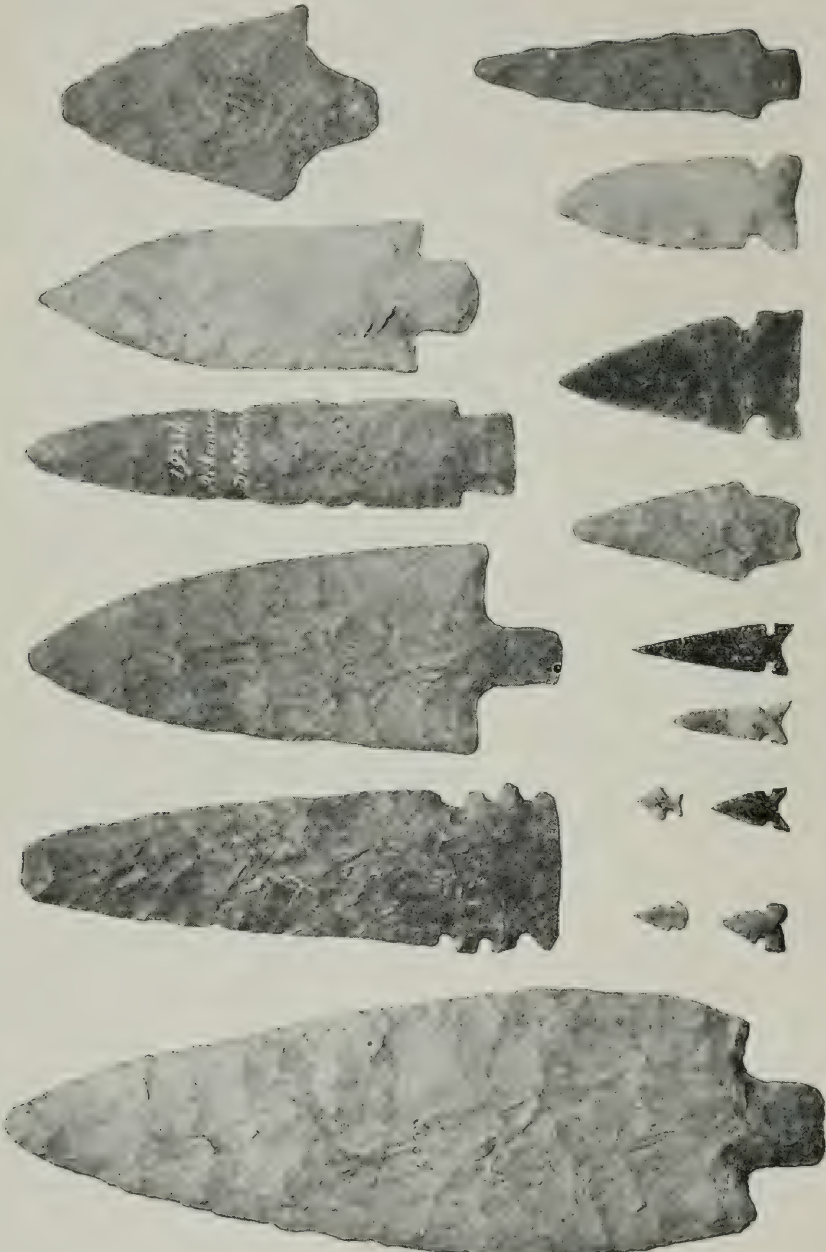
$2\frac{1}{4} \times 1 \times \frac{3}{8}$.

Cat. No. 57998, U.S.N.M.

Fig. 142, still lozenge-shaped, has no shoulder, but has a rudimentary base. The arrow maker has not, as in the former instance, worked the base to a point, but has left it one-fourth of an inch in width. This specimen is from Connecticut, is of the dark-gray flint common to that State, and is a fair sample of the average size of this class of arrowpoint.

Fig. 143 is of black flint from New York, of larger size than usual, but carries with it the simplicity of form and rudeness of manufacture mentioned of the others. The stem is still lozenge-shaped, no shoulder, and again the rudimentary base which here is about one-half an inch thick.

Fig. 144 is a specimen from Tennessee which merely repeats the peculiarities of the former specimens.



STEMMED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class B.

EXPLANATION OF PLATE 34.

1	2	3	4	5	6		
15	16						
14	13	12	11	10	9	8	7

Stemmed Arrowpoints, Spearheads, or Knives.

Class B.

Fig. 1. Chert.
(Cat. No. 6802, U.S.N.M. Ohio. J. H. Devereux.)

Fig. 2. Rough Ironstone.
(Cat. No. 7007, U.S.N.M. Dennysville, Washington County, Maine. Benjamin Lincoln.)

Fig. 3. Argillite.
(Cat. No. 18004, U.S.N.M. Connecticut. J. H. Clark.)

Fig. 4. Dark-gray Flint.
(Cat. No. 19356, U.S.N.M. Mineral Springs, Arkansas. Dr. E. W. McCreary.)

Fig. 5. White Chert.
(Cat. No. 99307*a*, U.S.N.M. Boone County, Missouri. G. W. Clements.)

Fig. 6. Quartzite.
(Cat. No. 748, U.S.N.M. District of Columbia. James Webster.)

Fig. 7. Argillite.
(Cat. No. 137563, U.S.N.M. Trenton, New Jersey. Thomas Wilson.)

Fig. 8. White Flint.
(Cat. No. 59173, U.S.N.M. Hancock County, Illinois. M. Tandy.)

Fig. 9. Pale-brown translucent Chalcedony.
(Cat. No. 59002, U.S.N.M. Pueblo of Taos, New Mexico. Capt. M. Wheeler, U. S. Geological Survey.)

Fig. 10. Quartzite.
(Cat. No. 139253, U.S.N.M. District of Columbia. S. V. Proudfit.)

Fig. 11. Black Obsidian.
(Cat. No. 34564, U.S.N.M. Stockton, San Joaquin County, California. L. Belding.)

Fig. 12. Pink Chert.
(Cat. No. 43032, U.S.N.M. Stockton, California. L. Belding.)

Fig. 13. Greenish-black Flint.
(Cat. No. 42650, U.S.N.M. San Joaquin County, California. L. Belding.)

Figs. 14, 15. Straw-colored Flint.
(Cat. No. 136960*a*, *b*, U.S.N.M. Labette County, Kansas. W. S. Hill.)

Fig. 16. Gray Flint.
(Cat. No. 17493, U.S.N.M. Maysville, Mason County, Kentucky. J. W. Pearce.)

CLASS B.—SHOULDERED BUT NOT BARBED. (Plate 34.)

Implements of this class are more numerous than those of any other division. There is this pronounced difference between them and any others we have described. The implements have two parts with different functions: (1) the blade which comprises the point and edges, and is for piercing or cutting, and (2) the stem, for insertion in a shaft or handle.

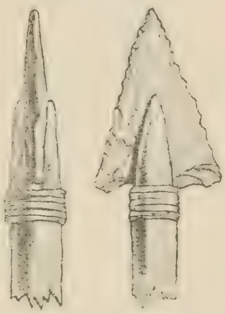


Fig. 145.

PREHISTORIC STONE ARROWPOINT INSERTED IN SHAFT AND TIED WITH FIBER.

Found in peat-moss of Giessboden, Switzerland.

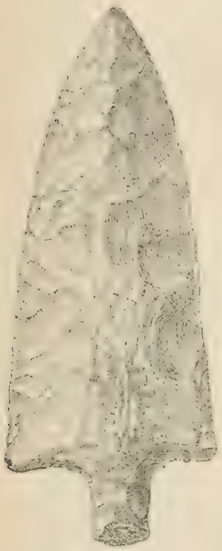


Fig. 146.

STEMMED ARROWPOINT OF BLACK FLINT, SHOULDERED BUT NOT BARBED.

Plainfield, Windham County, Connecticut.

Division III, Class B.

$5\frac{5}{8} \times 2\frac{1}{4} \times \frac{3}{8}$.

Cat. No. [illegible], U. S. N. M.

We can not imagine the use of the stem to an arrowpoint or spearhead which would not be intended for insertion in a shaft or handle. The leaf-shaped may or may not have been inserted in a handle; many of them we know were not. It was the opinion of Dr. Rau that in certain specimens the base had served as a chisel or scraper. But the stem had no other function than for insertion in a shaft or handle. This function was subject to great variations, and, as we shall see, there were many kinds of stems and great variability in the mode of attachment.

Fig. 145 is one of the few specimens of ancient arrowheads found attached to its shaft or handle. It comes from the peat moss of Giessboden, Switzerland, and is figured in Keller's Lake Dwellings.[1] The handle is broken so that it is uncertain whether the implement was arrow or knife, but the bast or fiber with which it was lashed is still discernible. Similar specimens have been found occasionally in Ireland and in Germany.

Figs. 146 and 147 are the simplest and most pronounced of Class B, stemmed and shouldered, but not barbed. The stem is straight, with parallel edges and straight base; the shoulders are square and at

[1] Volume II, Plate XXXIX, No. 15, from which it is reproduced in Evans's Ancient Stone Implements, p. 364, fig. 343.

right angles to the stem, and so give it almost a triangular appearance. The edges are convex and symmetrical, and the point on the median line. They are from 3 to 5 inches long, and inserted in a proper shaft would make a good spear or lance, which in the hands of a strong and active man would be a most effective weapon. Many of the implements, all those of Class C, seem to have been shouldered with the idea of making a barbed weapon, but the first intention was to make a stemmed weapon.

Fig. 147.
STEMMED ARROWPOINT OF GRAY FLINT, SHOULDERED BUT NOT BARBED.
Kingston, Washington County, Rhode Island.
Division III, Class B.
$3\frac{3}{8} \times 2 \times \frac{1}{4}$.
Cat. No. 18053, U.S.N.M.

Fig. 148.
STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.
Groveport, Franklin County, Ohio.
Division III, Class B.
$3\frac{1}{8} \times 2 \times \frac{1}{2}$.
Cat. No. 7678, U.S.N.M.

Fig. 148 is impure flint bordering on chert or hornstone. The implement is rude and thick, the edges are rough and untrimmed, and the flakes have been large and coarse. Whatever of this may be charged against the material, it is certain that it might have been better finished with more time and greater skill, and, therefore, we must consider it as an incompleted specimen.

Fig. 149 is of hard gray slate. It is extremely rough in its chipping, although the outline may be good. Its stem is straight and parallel, the base concave, the shoulders, instead of being square, are at an upward angle, the corners project far beyond the edges so that they have the appearance of barbs projecting horizontally and not perpendicularly. They never could have been intended to serve as barbs and prevent the extraction of the weapon from the pierced flesh. The edges beyond the corners or barbs are nearly straight, but slightly convex at the point. The workmanship is so rude and the material so refractory that it is with difficulty one can discover the flakes by which it was worked.

Fig. 149.
STEMMED ARROWPOINT OF GREENISH-GRAY HARD SLATE, SHOULDERED BUT NOT BARBED.
Georgia.
Division III, Class B.
$4\frac{1}{2} \times 2 \times \frac{7}{10}$.
Cat. No. 19565, U.S.N.M.

Fig. 150.
STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.
Southold, Suffolk County (Long Island), New York.
Division III, Class B.
$2 \times 1\frac{1}{4} \times \frac{1}{2}$.
Cat. No. 21208, U.S.N.M.

Fig. 150 is of white quartz from Long Island, New York. The material is in abundance, wrought into oval scrapers, and found in the shell-heaps on the eastern end of Long Island. Its stem and base are

straight, the shoulders are slight and unsymmetrical, while the edges are straight and come to a point. The implement is exceedingly thick, the base being more than half as thick as it is wide. The workmanship is rude; one can scarcely see where any flakes have been struck off, and it would seem to have been broken to its present shape by blows given at random. We must remodel our ideas in regard to arrow shafts if we would have this implement inserted therein, whether to be fastened by ligatures or gum. It is probably unfinished.

Fig. 151.

STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.

Tennessee.

Division III, Class B.

$2\frac{1}{2} \times 1 \times \frac{5}{16}$.

Cat. No. 8238, U.S.N.M.

Fig. 152.

STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.

New Braunfels, Comal County, Texas.

Division III, Class B.

$1\frac{5}{8} \times \frac{7}{8} \times \frac{5}{16}$.

Cat. No. 21158, U.S.N.M.

Fig. 151 is somewhat the same form as those just described, but its workmanship is better. It has been fairly well chipped, the flakes taken off are easily recognizable, and the edges all around are fairly smooth and sharp. It is of reddish jasper. The stem is straight and parallel, the base is straight, the edges from the base to the blade are slightly concave, forming the shoulders; while those from the shoulder to the point are convex.

Fig. 152 is of whitish flint from Texas. It is rude in its manufacture, quite thick compared with the width, the stem is straight, the base slightly concave, the shoulders but little more than rudimentary, and altogether it serves to emphasize the difficulty of inserting these implements in a shaft in such manner as to serve as arrows.

Fig. 153.

STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.

Plantersville, Morehouse County, Louisiana.

Division III, Class B.

$2\frac{3}{8} \times 1\frac{1}{4} \times \frac{3}{8}$.

Cat. No. 34407, U.S.N.M.

Fig. 154.

STEMMED ARROWPOINT OF PALE GRAY FLINT, SHOULDERED BUT NOT BARBED.

St. Mary County, Maryland.

Division III, Class B.

$3\frac{3}{4} \times 2\frac{1}{4} \times \frac{1}{4}$.

Cat. No. 12185, U.S.N.M.

Fig. 153 is of bluish chalcedony from Louisiana. It is much finer and better made, thinner compared with the width, and would be much easier inserted in an arrow shaft or handle. Its stem is tapering, the base straight, the shoulders indefinite, the edges convex and coming together form a point.

Fig. 154 has the edges of its blade straight and not convex. The point and corners are somewhat rounded; it is shouldered but not barbed, the stem is expanding, and the base is slightly concave. Its size, length, and width, compared with thickness, place it on the border between an arrowpoint and a spearhead.

Fig. 155 is similar to fig. 151, just described. Though widely separated by distance, the former coming from Tennessee, the latter from Pennsylvania, they have great resemblance. Both are of jasper, with apparently the same style of workmanship. The base, stem, and shoulders of the latter are much the same as the former, except that they are accentuated. The stem is narrower, its lines more concave or slightly more expanding toward the base, where they form corners of an acute angle. The base is slightly concave where the other is straight. The implement is the same length as fig. 151, though narrower and thinner.

Fig. 155.

STEMMED ARROW-POINT OF YELLOWISH-BROWN JASPER, SHOULDERED BUT NOT BARBED.

Susquehanna River, Pennsylvania.

Division III, Class B.

$2\frac{1}{2} \times \frac{3}{4} \times \frac{1}{4}$.

Cat. No. [illegible], U.S.N.M.

Fig. 156 is from Ohio. It, like the former specimen, is fairly well chipped, flakes plainly to be seen, and the edges and point comparatively smooth and sharp. The stem is straight, its edges parallel, and the base straight and square. The shoulders are formed after the same manner as fig. 151, preceding, and simply swell out so as to make a more pronounced shoulder than in that specimen. The edges are convex and coming together form the point.

Fig. 156.

STEMMED ARROW-POINT OF YELLOWISH-GRAY FLINT, SHOULDERED BUT NOT BARBED.

Brownsville, Licking County, Ohio.

Division III, Class B.

$1\frac{1}{4} \times 1 \times \frac{3}{8}$.

Cat. No. 12487, U.S.N.M.

Figs. 157 and 158, the former from Tennessee, the latter from Massachusetts, are almost identical in form. The former is of gray, the latter of black flint. With exceptions of material, color, and size, they are the same. If they were to be compared by form only, scarcely anyone would be able to detect a difference between them. Their edges are straight and come directly to a point. Their shoulders are horizonal, not barbed; the notch which forms the stem is concave and carried to the base of the stem; the base is square and dressed to a smooth edge so that it can be inserted in a split arrow shaft, while the notches on either side afford excellent supports for attachment by ligatures.

Fig. 157.

STEMMED ARROW-POINT, SHOULDERED BUT NOT BARBED.

Lincoln County, Tennessee.

Division III, Class B.

$2\frac{1}{8} \times 1 \times \frac{1}{4}$.

Cat. No. 61123, U.S.N.M.

Fig. 158.

STEMMED ARROW-POINT, SHOULDERED BUT NOT BARBED.

South Dennis, Barnstable County, Massachusetts.

Division III, Class B.

$1\frac{5}{8} \times \frac{7}{8} \times \frac{1}{4}$.

Cat. No. 18056, U.S.N.M.

Fig. 159 has a stem similar to figs. 157 and 158. The notch which forms it is concave, extending from shoulder to base and making an expanding stem with convex base. The edges are convex and, converging symmetrically, form a medium sharp point.

The next two specimens (figs. 160, 161), while having stems shouldered and not barbed, belong to Class B, but represent a marked difference from the former specimens. While the edges of the stem are straight and parallel, the base is convex. No reason has ever been given for this peculiarity, but it is a noticeable one and involves another even less explainable. Why the stem of an arrowpoint intended for insertion in a shaft should be made convex instead of straight or concave, is a matter of but slight importance and need in itself excite no curiosity; but all bases of stems which are convex have been worn or rubbed, or in some way made smooth. They have not been polished or ground upon the sides, but have been operated in a reverse manner against the edge of the base, and have made it blunt and smooth and not sharp. It would be beyond the author's province to say that this is universal, for no man could have had sufficient experience to justify such a statement, but in the U. S. National Museum thousands of such arrowpoints have been tested and 90 per cent or more of them have been found to be in this condition. No explanation has ever been given, nor has any been suggested. It is more marked in the cases of leaf-shaped implements which have been transformed into stemmed arrowpoints, leaving the convexity of the base unchanged. The points and edges seem to have had no share in the operation and they continue rough and sharp. Fig. 160 is of yellowish jasper, comes from Lincoln County, Mississippi, and is doubtless from the same jasper quarry which furnished the great number of jasper beads found there in a workshop by Mr. Keenan and described by him.[1] Fig. 161 is the same form as the preceding. It is of white flint from Illinois, and is much finer and more delicate than the jasper one, but it has the convex base, the smoothed condition of which is quite perceptible.

Fig. 159.
STEMMED ARROWPOINT OF BLUISH CHALCEDONIC FLINT, SHOULDERED BUT NOT BARBED.
Ohio.
Division III, Class B.
$2\frac{1}{4} \times 1\frac{1}{4} \times \frac{5}{16}$.
Cat. No. 16482, U.S.N.M.

Fig. 160.
STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.
Division III, Class B.
$2\frac{5}{8} \times 1 \times \frac{3}{8}$.
Cat. No. 9789, U.S.N.M.

Fig. 161.
STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.
St. Clair County, Illinois.
Division III, Class B.
$1\frac{7}{8} \times \frac{7}{8} \times \frac{1}{4}$.
Cat. No. 15323, U.S.N.M.

Fig. 162.
STEMMED ARROWPOINT OF GRAY FLINT, SHOULDERED BUT NOT BARBED.
Edmondson County, Kentucky.
Division III, Class B.
$3 \times 1\frac{3}{8} \times \frac{3}{8}$.
Cat. No. 59347, U.S.N.M.

The next three figures (162–164) represent another form of base. The

[1] Smithsonian Report, 1877, p. 291.

edges and points are the same as in other specimens. They are shouldered, but not barbed, and the stem at its base is the same as other stems; but instead of its edges being parallel and making a straight or square stem, they are convex and bring the base of the stem to a point. Fig. 162 is a good representative of this type. It is symmetrical; the chipping is not fine, but fairly well done; the base and shoulders are square, the stem contracting by convex edges, and the base pointed. Fig. 163 is from Tennessee, while the former is from Kentucky; but the material of both is the same quality of gray flint, and as the two States are contiguous, we may easily suppose that the American Indian who made these implements was not governed by State lines, and both points may have come from the same quarry. The base is pointed, made so by convex edges. Fig. 164 has the same contracted stem, but its edges are straight and not convex and its base is pointed. It comes from a locality far distant from the others, namely, California, showing that these forms were not confined to a given locality. It is well chipped, symmetrically formed, but has the projecting horizontal barb, as was described in fig. 149. It is long and slender, and could have penetrated the flesh of the game or enemy a distance of $2\frac{1}{2}$ inches without interference from these horizontal projections.

Fig. 163.

STEMMED ARROW-POINT, SHOULDERED BUT NOT BARBED.

Division III, Class B.

$2\frac{7}{8} \times 1 \times \frac{1}{4}$.

Cat. No. 8914, U.S.N.M.

Fig. 164.

STEMMED ARROW-POINT OF BLACK FLINT, SHOULDERED BUT NOT BARBED.

San Miguel Island, California.

Division III, Class B.

$2\frac{1}{2} \times 1 \times \frac{5}{16}$.

Cat. No. 15746, U.S.N.M.

The type of which the author is now to speak has given him more trouble in its classification than any other, and yet he has concluded to classify it as a stemmed arrowpoint, shouldered but not barbed, and has put it in Class B. The blades may be thick or thin, wide or narrow, edges concave, straight, or convex, points sharp or blunt, and so through all the variations. The stem is formed by notches made in the edges near the lower end which, with the notch, forms the base of the arrowpoint.

Fig. 165.

STEMMED ARROW-POINT, SHOULDERED BUT NOT BARBED.

Ohio.

Division III, Class B.

$2\frac{1}{8} \times 1 \times \frac{1}{4}$.

Cat. No. 16481, U.S.N.M.

Fig. 166.

STEMMED ARROW-POINT OF DARK GRAY FLINT, SHOULDERED BUT NOT BARBED.

Tennessee.

Division III, Class B.

$1\frac{3}{4} \times 1 \times \frac{1}{4}$.

Cat. No. 8238*a*, U.S.N.M.

Fig. 165 is a representative of the type. It is of black flint; its edges are convex, drawing gradually to a point; the base is straight and

as wide as the broadest part of the blade. Its base is formed by two notches made in each edge opposite each other and forming, so far as concerns the edges, a groove around the implement which may have been utilized for fastening the arrow shaft by a ligature. These notches are about one-fourth of an inch wide and as much deep, and are distant from the base about one-fourth of an inch, so that they have been denominated in some other classification as "notched on the edge near the base." This notching has left the base its original width and unchanged, as though the notches had not been made nor the implement transformed from a leaf-shaped or possibly triangular arrowpoint into a stemmed one.

Fig. 167.
STEMMED ARROWPOINT, SHOULDERED BUT NOT BARBED.
Division III, Class B.
$1\frac{3}{4}$ x 1 x $\frac{3}{16}$.
Cat. No. 8336, U.S.N.M.

Fig. 166 is much smaller than the former, but size does not seem to have affected this type of arrowpoint more than it has the others. The implement is symmetrical, edges are convex, and the outline can be traced past the notches to the base, and, but for the notches, it would have been a leaf-shaped implement of Class B, pointed at one end and concave at the base. The notches are about one-fourth of an inch wide and deep, and the distance from the base is about three-eighths of an inch. We will see in the next class how, evidently, some of these stemmed arrowpoints were made from leaf-shaped implements, by the introduction of these notches. In the present case the notches are horizontal and form shoulders but not barbs. In the next class (C) they will be at an upward angle toward the center, their shoulders form barbs, and they pass into that class and are not further noticed in this.

Fig. 168.
STEMMED ARROWPOINT OF WHITE JASPERY FLINT, SHOULDERED BUT NOT BARBED.
West Bend, Washington County, Wisconsin.
Division III, Class B.
3 x $1\frac{1}{4}$ x $\frac{1}{4}$.
Cat. No. 32169, U.S.N.M.

Fig. 167 is of gray flint from Ohio. It is rather small and has the same horizontal notches, smaller than those noticed before, but the outline of the leaf-shaped implement is more apparent in it than in the others. That it was originally a leaf-shaped implement, transformed by the notches into a stemmed and shouldered arrowpoint, is satisfactorily shown from an inspection of the implement. It has the convex base which was referred to and described under fig. 160 as polished or rubbed smooth on its edge. This peculiarity is wonderfully well represented in the specimen now under consideration. The edge of the base is blunt and smooth, while the edges and point of the blade are rough and sharp as any ever were. There are some peculiarities appertaining to the implements and objects of prehistoric man which, by reason of their repetition, have become accepted facts, the explanation of which has as yet defied all theories of the most inventive imagination. This is one.

Fig. 168, instead of being leaf-shaped as have been some of the foregoing, was a triangular arrowpoint. Its edges are straight, and, approaching each other, form the point at an acute angle. The base is straight and square, but one-fourth of an inch above it toward the point are two notches, one on each side, about one-fourth of an inch each way, which transform it from a triangular into a stemmed arrowpoint.

Fig. 169.

STEMMED ARROWPOINT OF BROWN FLINT, SHOULDERED BUT NOT BARBED.

Dennysville, Washington County, Maine.

Division III, Class B.

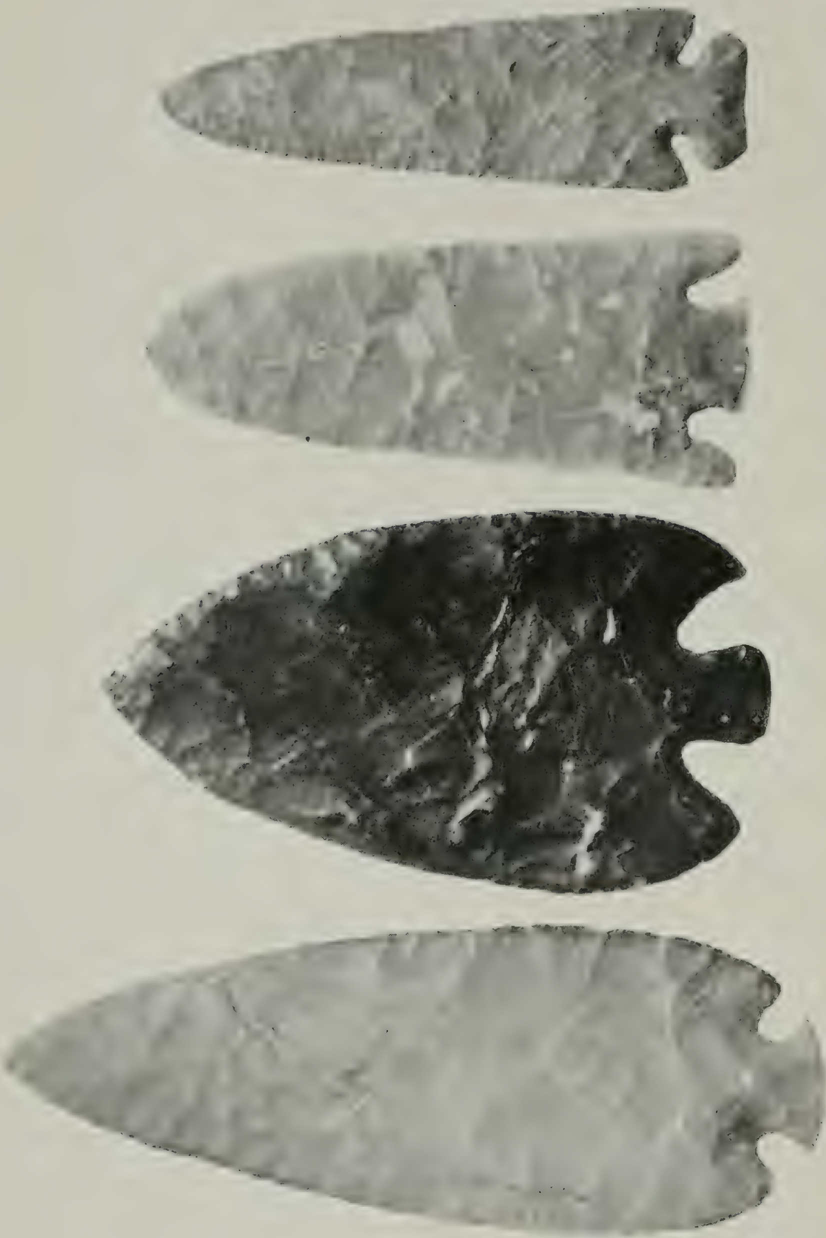
$6\frac{1}{4} \times 1\frac{3}{4} \times \frac{7}{16}$.

Cat. No. 7007, U.S.N.M.

Fig. 169, while belonging to the same class, has the peculiarity of three notches on the edges instead of one, as in all former illustrations. It is much larger than any of the others, its edges are straight, or nearly so, and, but for the notches which transform it into a stemmed implement, it would be nearly a triangular one. The base is straight and at right angles with the median line, the notches are about one-fourth of an inch each way and separated from each other about one fourth of an inch. It would appear as though they might have been employed for three ligatures, or for ligature in three places, the farthest of which would be about $1\frac{1}{8}$ inches from the base, thereby giving the handle that much more firmness and solidity in its attachment.

A type of arrowpoint belonging to this class has been found and identified by Dr. Abbott, with such peculiarities as demanded at his hands a separate and extended notice, which he gave in Primitive Industry.[1] An illustration of this implement is shown in Plate 34, fig. 7. Dr. Abbott believes in the existence in America, and especially on the Delaware River (the valley of the Delaware), of a Paleolithic civilization which, of course, antedated that of the Neolithic or American Indian civilization. All, or nearly all, the Paleolithic implements found in the glacial gravel of the Delaware River at Trenton, New Jersey, have been of argillite. It is his belief that this material was used principally by Paleolithic man. The specimens under consideration are of argillite and much weathered, showing a high antiquity. They are now a light gray color, but originally and on the inside are coal-black. The stone of which they are made is hard, and they could be chipped to a sharp point and edge. Their chipping has been rude and the flakes comparatively large. They are long and narrow, their edges nearly straight, approaching until they form a point. The shoulders were nearly square, not barbed, the stem short, edges parallel, and base straight and square. Altogether it is rude and unattractive, but in its original condition of sharp point and

[1] See also Popular Science Monthly, XXII, 1883, p. 315.



STEMMED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class C.

EXPLANATION OF PLATE 35.

1 2 3 4

STEMMED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class C.

Fig. 1. FINE-GRAINED QUARTZITE.

(Cat. No. 88339, U.S.N.M. De Soto, Vernon County, Wisconsin. J. D. Middleton.)

Fig. 2. DARK-BROWN CHALCEDONY (cast).

(Cat. No. 98340, U.S.N.M. Warners Landing, Vernon County, Wisconsin. J. L. De Witt.)

Fig. 3. BLUE-GRAY TRANSLUCENT CHALCEDONY.

(Cat. No. 148034, U.S.N.M. Mound, Putnam County, Ohio. J. R. Nisley.)

Fig. 4. BROWN FLINT.

(Cat. No. 173745, U.S.N.M. Williamson County, Illinois. H. C. Duvall.)

STEMMED ARROWPOINTS, SPEARHEADS, OR KNIVES.
Class C.

EXPLANATION OF PLATE 36.

1 2 3 4 5 6

16 15 14 13 12 11 10 9 8 7

STEMMED ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class C.

Fig. 1. LEAD-COLORED FLINT.
(Cat. No. 6159, U.S.N.M. Saratoga County, New York. Col. E. Jewett.)

Fig. 2. ROSE-TINTED QUARTZITE.
(Cat. No. 137927, U.S.N.M. Washington County, Missouri. Dr. Charles Rau.)

Fig. 3. VARIEGATED PINK AND SLATE-COLORED FLINT.
(Cat. No. 7659, U.S.N.M. Groveport, Ohio. W. R. Limpert.)

Fig. 4. GRAY FLINT OR CHERT.
(Cat. No. 172831, U.S.N.M. Ohio. W. K. Moorehead.)

Fig. 5. BLUE-GRAY CHALCEDONIC FLINT.
(Cat. No. 7108, U.S.N.M. Mount Carmel, Illinois. Mr. Ridgway.)

Fig. 6. PYROMACHIC FLINT.
(Cat. No. 31954, U.S.N.M. Montgomery County, Texas. Dr. J. L. Irish.)

Fig. 7. GRAY FLINT.
(Cat. No. 34581, U.S.N.M. McMinnville, Tennessee. W. W. Phillips and Dr. T. M. Brewer.)

Fig. 8. GRAY FLINT.
(Cat. No. 8239, U.S.N.M. Tennessee. J. H. Devereux.)

Fig. 9. YELLOWISH GRAY CHALCEDONIC FLINT.
(Cat. No. 10820, U.S.N.M. Milnersville, Ohio. D. Thompson.)

Fig. 10. BLUE-GRAY CHALCEDONIC FLINT.
(Cat. No. 18084, U.S.N.M. Paint Lick, Kentucky. J. B. Clark.)

Fig. 11. OPALESCENT CHALCEDONIC FLINT.
(Cat. No. 15231, U.S.N.M. Santa Barbara County, California. Paul Schumacher.)

Fig. 12. DRAB FLINT.
(Cat. No. 32440, U.S.N.M. Orange County, Indiana. F. M. Symmes.)

Fig. 13. BROWN FLINT.
(Cat. No. 8239*a*, U.S.N.M. Tennessee. J. H. Devereux.)

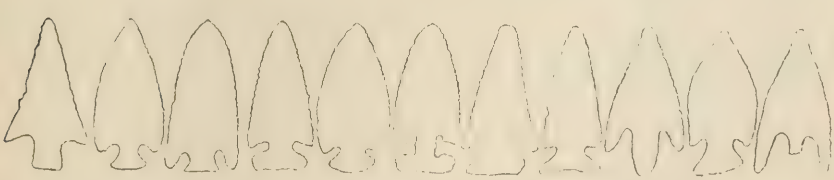
Fig. 14. BLACK FLINT.
(Cat. No. 34583, U.S.N.M. Sharpsburg, Maryland. A. P. Smith.)

Fig. 15. BLUE-GRAY CHALCEDONIC FLINT.
(Cat. No. 12681, U.S.N.M. Oregon. Paul Schumacher.)

Fig. 16. GREEN JASPERY FLINT.
(Cat. No. 12682, U.S.N.M. Oregon. Paul Schumacher.)

edges it might have been a very effective weapon. Dr. Abbott asserts that the large proportion of these implements are found in the alluvial soil in proximity to the glacial gravel at a depth that proves their antiquity. Their number increases in proportion to the depth of the excavation for a certain distance, when they stop, while the Paleolithic implements proper continue to a greater depth. Dr. Abbott believes these implements to have been used as harpoons for the capturing of fish, and he cites, as evidence supporting his theory, the fact that they are nearly all found along the borders of the streams. He remarks the great similarity of these implements with those used for a similar purpose by the Eskimos, and cites corresponding implements and figures described by Sir John Lubbock.[1] He propounds the theory whether the Eskimos may not have been driven down by the glaciers and occupied the territory of New Jersey, New York, Connecticut, etc., or whether driven down or not, they may not, with their present love of cold or for other reasons unknown, have dwelt near the foot of the glacier in these States and followed it up in its retreat north, until they came to occupy the present boreal region. It would seem to be indisputable that the territory around the feet of these glaciers was occupied by man, if it had not been prior to their descent. The implements found in the Trenton gravels would seem to show this. If this be accepted, the question may be fairly asked, What became of this people; who are their descendants; and, after the retreat of the glacier and the exposure of the country north, what course of departure, extension, or migration did their descendants take? These theories are not yet demonstrated and may never be, but they are worthy of profound investigation and study.

CLASS C.—SHOULDERED AND BARBED. (Plates 35, 36.)



The prehistoric man did not, in his manufacture of these implements, divide them into classes. The different forms were made according to the possibilities of the material, the dexterity of the workman, and the exigencies of the situation. The classification is now made solely for the purpose of enabling us in modern times to describe and understand them. Class C comprises those which have stems, shoulders, and barbs. The difference between the present class, C, and the preceding, B, is that the shoulders in the former were horizontal, at a right angle or more than a right angle to the median line

[1] Prehistoric Times, p. 503, fig. 218.

from the base upward. In the present class the point forming the shoulder is brought downward toward the base, so that it forms less than a right angle to the median line: this has the effect of making the shoulder an acute angle, and this angle forms the barb. The implements of this class, taken in their entirety, may be of different forms; sometimes they may be leaf-shaped, sometimes triangular; they may have either convex, straight, or concave edges; the point may be sharp or blunt; the base may be concave, straight, or convex. All these may exist in this subdivision, provided they are stemmed, shouldered, and barbed. No argument is necessary to justify a class which includes so many forms as those just mentioned. If a separate division should be given to each of these different forms when accompanied by barbs, the same should be done when without barbs. This would create so many divisions as to become unrecognizable and practically useless. This classification is based on the salient points of difference.

Fig. 170.

STEMMED SPEARHEAD, SHOULDERED AND BARBED.

Division III, Class C.

7 x 4 x $\frac{5}{16}$.

Cast, Cat. No. 98340, U.S.N.M. (Original in possession of Dr. J. L. DeWitt.)

The first illustration (fig. 170) presents a type of barbs by which they can be known and recognized throughout the description. It is a magnificent implement, translucent dark-brown chalcedony, and was found in a mound in Vernon County, Wisconsin. The figure is from a cast in the U. S. National Museum. The blade shows it to have been practically a leaf-shaped implement of Class B, one end pointed and the other convex. Whether it was originally thus, and afterwards transformed into a stemmed one, is unimportant and only a matter for conjecture. The notches have been made near the base, are V-shaped, and necessarily deep and wide; they form the edges of the stem nearly parallel and make it straight, neither expanding nor contracting. The V-shaped notch causes the shoulder to descend so that its junction with the outer edge forms an acute angle, and this acute angle forms the barb of the implement. The benefit of the barb in an arrowpoint or spearhead is that, having entered the flesh of the game or enemy, the barb prevents its withdrawal, as with the barb of the fishhook.

That this form was somewhat a matter of taste, and not always for the utilitarian purpose mentioned, is apparent upon a glance at this illustration and the two following. In these three specimens the size of the implement is so great and, compared therewith, the barbs so small that they are insignificant in actual utility. The thrusting of either one of these large specimens into any known game or enemy would be sufficient to kill the animal independent of the use of the barbs or the withdrawal of the weapon. It goes without saying that these, and possibly one other in this class, were too large for any possible use as arrows, and perhaps as knives, and if they had any utilitarian purpose it could only have been as a spearhead. It is a matter for conjecture and investigation whether they might not have served for ceremonial purposes, or as some insignia of authority or command, as the staff of a marshal, the scepter of a monarch, or the mace in the House of Representatives of Congress.

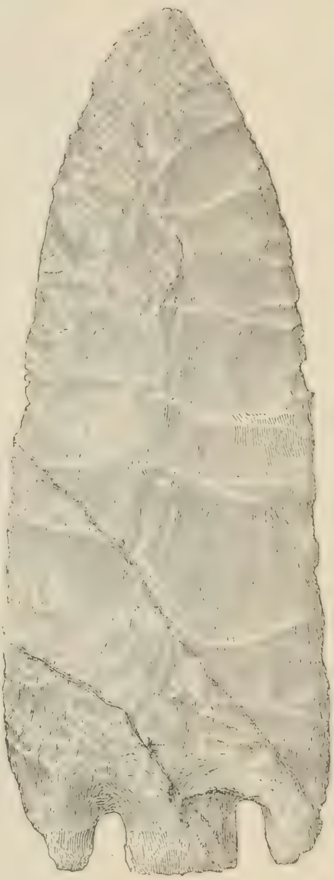


Fig. 171.

STEMMED SPEARHEAD OF WHITISH CHALCEDONY, SHOULDERED AND BARBED.

Shreveport, Caddo County, Louisiana.

Division III, Class C.

$9\frac{1}{4} \times 3\frac{1}{2} \times \frac{3}{4}$.

Cat. No. 10095, U.S.N.M.

Fig. 171 is one of these remarkable implements. It is white or whitish translucent chalcedony, impure to be sure, but still fine enough with its extraordinary size to make it a magnificent implement. But for the barbs it would be assigned to the leaf-shaped Class B. Its edges are symmetrically convex and, converging, form the point. The notches forming the barbs have been made perpendicularly upward from the base, and not, as usual, horizontally from the edge. The notches are half an inch wide and three fourths of an inch deep; they leave the barbs to be three-fourths of an inch long, descending perpendicularly almost even with the base. The base is straight and square; the stem has parallel edges, is straight and not pointed. The whitish chalcedony, the material of this specimen, is not rare in the locality in which this was found (Shreveport, Louisiana), although the mine or quarry from which the material comes has, it is believed, never yet been found. The author is the owner of

fourteen such implements of the same material and the same general type, found in a cache in Pike County, Arkansas (see Plate 61). They were laid side by side, the edges overlapping and buried on the side of

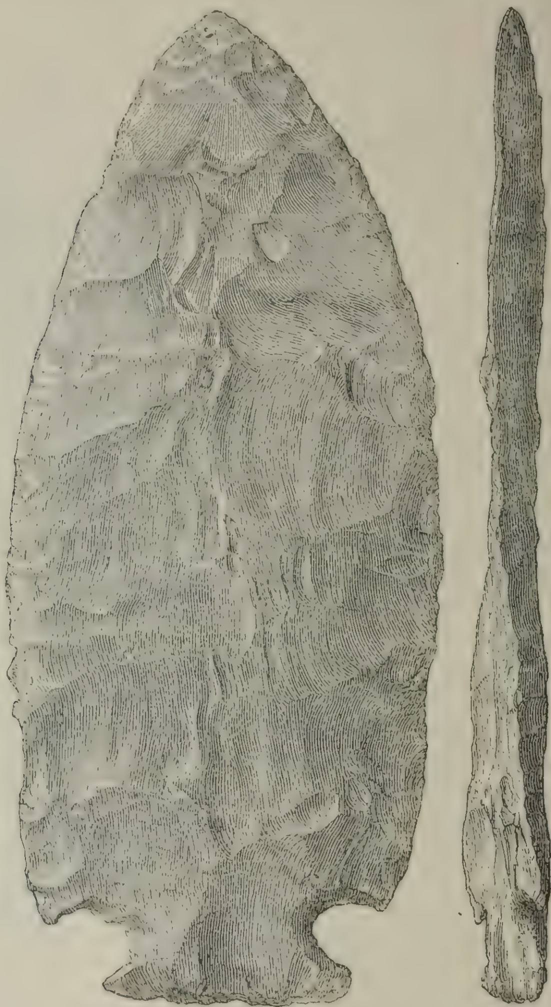


Fig. 172.

STEMMED SPEARHEAD, SHOULDERED AND BARBED.

Crawford County, Wisconsin.

Division III, Class C.

$10\frac{1}{2} \times 4\frac{1}{2} \times \frac{1}{2}$.

Cast, Cat. No. 39016, U.S.N.M.

the hill in the solid yellow clay. The erosion by rains and wash brought the surface down to them, and they were found slightly protruding.

Fig. 172 is an enormous implement of the same class. The U. S.

National Museum possesses only a cast of it, the original being in the possession of Mr. F. J. Miller, Prairie du Chien, Wisconsin. It is of brown jasper, and has been made from an immense flake of that material which has been struck off with a perceptible twist, as shown by the edge view accompanying. It is also rudely leaf-shaped, pointed at one end, the base nearly straight and square, the notches forming the barbs being oval or shell-like and made in the edges, not disturbing the

Fig. 173.

STEMMED SPEARHEAD OF GRAY FLINT, SHOULDERED AND BARBED.

Saratoga County, New York.

Division III, Class C.

$5\frac{3}{8}$ x $2\frac{5}{8}$ x $\frac{9}{16}$.

Cat. No. 6159, U.S.N.M.

Fig. 174.

STEMMED SPEARHEAD OF GRAY FLINT, SHOULDERED AND BARBED.

McMinnville, Warren County, Tennessee.

Division III, Class C.

$4\frac{3}{8}$ x $1\frac{1}{4}$ x $\frac{3}{8}$.

Cat. No. 34581, U.S.N.M.

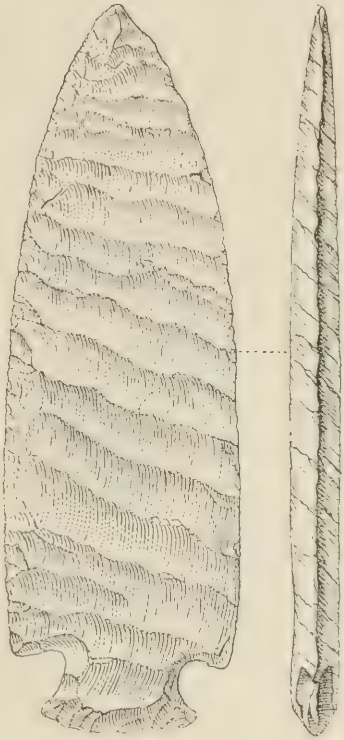


Fig. 175.

STEMMED SPEARHEAD, SHOULDERED AND BARBED.

Division III, Class C.

$3\frac{3}{4}$ x $1\frac{1}{4}$ x $\frac{1}{4}$.

Cat. No. 43134, U.S.N.M.

base, although coming within a quarter of an inch of it.

Fig. 173, though large even for a spearhead, does not compare in size with the enormous specimen just described. It is $5\frac{3}{8}$ inches long, has somewhat the appearance of a leaf-shaped implement, although there is no evidence of its transformation. It is of flint and has been made from a nodule, the concentric bands of which are to be seen, the point of the base coming almost to the surface of the nodule. The edges are convex, the stem is slightly contracting, and the base is convex. The barbs are well pronounced and form an acute angle; they have no relation to the stem, but are attached to and form a part of the blade.

The blade is twisted from the right side at the base to the left side at

the point. The twist is about equal to the thickness of the implement, and arises, not from the natural shape of the flake, but by chipping the edges all from one side. Whether this twist would give the missile a rotary motion as it was discharged from the bow, is a question examined in the division of peculiar forms, Class A, beveled edges, p. 931.

Fig. 176.

STEMMED ARROW-POINT OF GRAY FLINT, SHOULDERED AND BARBED.

Orange County, Indiana.

Division III, Class C.

$1\frac{7}{8} \times \frac{3}{4} \times \frac{3}{16}$.

Cat. No. 32440, U.S.N.M.

Fig. 174 appears to have been one of the leaf-shaped implements of Class B. It has a long, fine point, edges convex, base the same, with narrow notches in the edge near the base. The edge of the convex base has been ground down or worn smooth as described in figs. 160 and 161 of Class B, stemmed, Division III, p. 921.

Fig. 177.

STEMMED ARROW-POINT OF PALE BROWN FLINT, SHOULDERED AND BARBED.

Santa Barbara County, California.

Division III, Class C.

$1\frac{3}{4} \times 1\frac{3}{8} \times \frac{1}{4}$.

Cat. No. 15281, U.S.N.M.

Fig. 175 has convex edges converging symmetrically to the point, the base is slightly convex, while the notches which have made it into a stemmed and barbed implement are at the corners formed by the junction of the edges with the base. The V-shaped notches make the expanding base, and change the shoulders into barbs. This specimen is from a mound near Naples, Illinois, excavated by Mr. J. G. Henderson. The mound and the associated objects are described in the Smithsonian Report of 1882, where this is fig. 13 *a* (p. 696). The material is translucent pale brown chalcedony. This is the finest specimen of flint chipping in the U. S. National Museum. There may have been others exceedingly fine and highly interesting, and it may be difficult to draw lines of comparison between the various degrees of fineness, but the author has never seen anything showing a higher degree of mechanical art and manual dexterity in flint chipping.

Fig. 178.

STEMMED ARROW-POINT OF DARK GRAY FLINT, SHOULDERED AND BARBED.

Sharpsburg, Washington County, Maryland.

Division III, Class C.

$1\frac{1}{2} \times \frac{7}{8} \times \frac{3}{16}$.

Cat. No. 34583, U.S.N.M.

Fig. 179.

STEMMED ARROW-POINT, SHOULDERED AND BARBED.

Oregon.

Division III, Class C.

$1\frac{5}{8} \times 1 \times \frac{1}{8}$.

Cat. No. 12680, U.S.N.M.

Fig. 176, though reduced in size, is of sufficient weight to give momentum to the arrow, and will probably secure greatest flight. Its edges are symmetrically convex and, converging, form the point. The base is slightly convex, while the notches which form the barbs are in the edge near the base.

Fig. 177 has edges slightly convex, which come together at the point with a wide angle, making the implement of considerable breadth in proportion to its length. The stem is contracting and the base

PECULIAR FORMS OF ARROWPOINTS, SPEARHEADS, OR KNIVES.
Class A.

EXPLANATION OF PLATE 37.

1 2 3 4 5 6 7

15 14 13 12 11 10 9 8

Peculiar Forms of Arrowpoints, Spearheads, or Knives.

Class A.

Fig. 1. Light-brown Flint.
(Cat. No. 18800, U.S.N.M. Elkton, Giles County, Tennessee. J. R. Irby.)

Fig. 2. Blue-gray Flint.
(Cat. No. 13708, U.S.N.M. Perry County, Ohio. W. Anderson.)

Fig. 3. Dark Slate-colored Flint.
(Cat. No. 113684, U.S.N.M. Flint Ridge, Licking County, Ohio. Gerard Fowke.)

Fig. 4. Light-gray Flint.
(Cat. No. 30175, U.S.N.M. McKenzie, Carroll County, Tennessee. E. H. Randall.)

Fig. 5. Light-gray Flint.
(Cat. No. 58134, U.S.N.M. Fayetteville, Lincoln County, Tennessee. C. S. Grigsby.)

Fig. 6. Fawn-colored Flint.
(Cat. No. 8239. U.S.N.M. Tennessee. J. H. Devereux.)

Fig. 7. Straw-colored Flint.
(Cat. No. 99307, U.S.N.M. Boone County, Missouri. G. W. Clemens.)

Fig. 8. Pale-yellow Flint.
(Cat. No. 19965, U.S.N.M. Franklin, Williamson County, Tennessee. W. M. Clarke.)

Fig. 9. Fawn-colored Flint.
(Cat. No. 98375, U.S.N.M. Lauderdale County, Alabama. Frank Burns.)

Fig. 10. Light Silver-gray Flint.
(Cat. No. 97641, U.S.N.M. Monteur's Point, near Vincennes, Indiana. Robert Ridgway.)

Fig. 11. Lead-colored Flint.
(Cat. No. 32645, U.S.N.M. Murphysborough, Jackson County, Illinois. W. Anderson.)

Fig. 12. Yellow Flint.
(Cat. No. 171450, U.S.N.M. Waynesboro, Georgia. Dr. Roland Steiner.)

Fig. 13. Reddish-brown Flint.
(Cat. No. 171450*a*, U.S.N.M. Waynesboro, Georgia. Dr. Roland Steiner.)

Fig. 14. Brown Jaspery Flint.
(Cat. No. 171450*b*, U.S.N.M. Waynesboro, Georgia. Dr. Roland Steiner.)

Fig. 15. Dark Slate-colored Flint.
(Cat. No. 171450*c*, U.S.N.M. Waynesboro, Georgia. Dr. Roland Steiner.)

pointed. The notches which have formed the barbs have been made in the base and not in the edge. They are V-shaped and are perpendicular to the plane of the implement. The barbs continue on the line of the outside edges, and the widest place is across their extreme points. The material is reported as pale-brown flint, but it has the peculiarity of a brilliant shining luster resembling the brightest patina. Whether it is really patina, or only vitreous material, the author has not been able to determine. The specimen is too precious to be broken in order to show its interior.

Fig. 178 is barbed and, therefore, belongs to this class. It is broadest near the point. Its edges are of irregular convexity; there have been some others of much the same form as this, but their edges have been straight where this is convex, and instead of a curve there was a distinct angle, but these are considered only the peculiarities of the workman and to have served no particular end, while their rarity will not permit their being assigned a division by themselves.

Fig. 179 is one of the beautiful pale-green jasper specimens of diminutive size, delicate stem, and long, projecting, finely pointed barbs, peculiar to the Pacific coast, coming mostly from Oregon. It appears much smaller than its dimensions given in the legend would indicate. This is caused by its delicacy and fineness. Italy produces the only arrowpoints which compare with those of the Pacific coast in these fine qualities. The reader is referred to Plate 36 for other specimens.

DIVISION IV—PECULIAR FORMS.

This division includes those specimens which have such peculiarities as distinguish and separate them from the standard types. If the distribution of these specimens was general, or if they were found in numbers approximately equal with the others, they would themselves become standard types and each require a division of its own. It is because they do not belong to standard types, and are restricted in number or locality, that they are assigned to this division.

CLASS A.—BEVELED EDGES. (Plate 37.)

The blades of the ordinary arrowpoint are usually chipped from both sides so that the edges are formed on the central line, and a cross section is elliptical. This Class A is peculiar in that the chipping by which the edge is formed is all done from one side, and the edge is thrown or beveled to the plane of the other side. A cross section will

be rhomboidal, the two long sides being the width, and the two short sides or edges being the thickness of the blade.

Fig. 180.

PECULIAR FORM OF ARROWPOINT, WITH BEVELED EDGES.

Elkton, Giles County, Tennessee. Division IV, Class A.

Natural size.

It was for a long time believed that these bevel-edged arrowheads were simply freaks of the workmen, and were without signification or intention for particular purpose. Indeed that belief has not entirely passed away. Since beginning this paper the author, in order to demonstrate the truth of the matter, inaugurated a series of experiments. Selecting from the Museum collection a dozen or more representative specimens, he attached to each an arrow shaft, smooth, straight, without feathering, and the same size throughout. Repairing with these to the top of the tower of the Smithsonian building, he began by letting them drop straight to the ground, carried only with their own gravity, and next launching them in the air in every direction. He found a universal rotation. He pushed his experiments further by arranging these specimens in a sort of clamp of wire, the ends of which embraced the ends of the arrowpoints, care being taken to put the point of contact as near the center of gravity as possible. Thus held, the suspended or clamped implement was free to rotate longitudinally in either direction on the application of the slightest force. This machine was then used by pushing it with its clamped arrowpoint rapidly through the water in a large tub, and it was discovered that the resistance of the water produced a rotary motion of the implement. A more conclusive test was made at a machine shop where the arrowpoint, hung as aforesaid, was presented point foremost to the pipe of air from the driving fan, when the current immediately set it revolving. When the force of the current was increased, it increased the rapidity of the rotary movement. When the arrowpoint was turned about so as to present its base to the current of air, no rotary motion was produced.

These experiments were extended and continued to include any and every kind of bevel-edged arrowpoint and spearhead, always with the same result. It was obvious that the arrowpoint at rest presented to

a rapidly moving current of air would have the same effect as an arrowpoint shot from the bow. Most of the specimens of bevel edged arrowpoints and spearheads are chamfered one way, so that the movement usually was from right to left, contrary to the motion of the sun. All specimens of this kind employed in our experiments had that rotary motion from right to left. A few specimens, however, are made with the bevel the other way, and when they were presented to the current of air their rotary motion was in the opposite direction.

Fig. 181.

PECULIAR FORM OF ARROWPOINT, WITH BEVELED EDGES.

Tennessee.

Division IV, Class A.

$3\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{4}$.

Cat. No. 8233, U.S.N.M.

It is proper to add that these experiments were pushed to such extent and in such number, with such repetition of the same result, as to be conclusive that, whatever may have been the intention of the maker of the arrowpoints, the fact was that in their flight through the air the beveled edges produced the rotary motion.

Fig. 182.

PECULIAR FORM OF ARROWPOINT, WITH BEVELED EDGES.

Point Lick, Kentucky.

Division IV, Class A.

[illegible]

Cat. No. 18084, U.S.N.M.

While it would appear that this rotary motion must have been intended by the arrow maker when he made the beveled edge, yet the difficulty of solution of the problem why he made it thus is much increased when we consider the greater ease, the less labor, and the increased facility with which he might have accomplished the same rotary motion by twisting the feathers on the arrow shaft. Yet we find this exceeding rare; out of a thousand arrow shafts in the U.S. National Museum not more than a dozen have been found with twisted feathering.

The bevel-edged arrowpoint is peculiar in its distribution. It is confined to the interior and southern United States.

Fig. 183.

PECULIAR FORM OF ARROWPOINT, WITH BEVELED EDGES

Louisville, Kentucky.

Division IV, Class A.

$2\frac{1}{2} \times 1\frac{3}{8} \times \frac{3}{8}$.

Cat. No. 19246, U.S.N.M.

Fig. 180 (Cat. No. 18800, U.S.N.M.) is one of these bevel-edged arrowpoints, which, on account of its size, form, and definitely beveled edges, has been chosen and is here represented full size as a characteristic bevel-edged weapon. It is of light-brown flint and comes from Elkton, Giles County, Tennessee. Its base is convex and smoothed, as usual. It is notched, shouldered, and barbed and, but for the peculiarity of its beveled edges, would be placed in Class C, Division III.

Fig. 181 is the size of the average arrowpoint. It is $3\frac{1}{4}$ inches long, $1\frac{1}{4}$ inches wide, and from this size they descend to the smallest. The edges of this specimen are nearly straight, the base is concave, and the

notches which form it are made in the edges near the base. The angle of the shoulders form the usual barb; the projecting corners of the base may also form another pair of barbs. If the arrow shaft used on this specimen should be small in diameter, the points of the base would project beyond it, and thus form a double set of barbs.

Fig. 182 has the appearance of gray flint, but it is of translucent crystalline structure, and an inspection identifies it as chalcedony or chalcedonic flint. Its edges are curved, a union of concave and convex, making them slightly ogee. The base is straight, the barbs are long and thin, and, what is rare, are nearly the same size their entire length. The notch which forms them begins at the corners of the base and edge and, ascending at an angle of about 45 degrees toward the center of the implement, is one-half an inch long and only one-eighth of an inch thick or wide.

Fig. 183 is from Kentucky, gray flint, stemmed, shouldered, and barbed, and twisted to the left. The specimens of this class average from one-fourth to three-eighths of an inch in thickness, and are of all sizes and lengths. Reference is made to Plate 37 for other specimens.

Rev. J. G. Wood,[1] author of The Natural History of Man, describes arrows with a rotary motion, which he says are used with the blowgun:

> Rotary motion was communicated to the arrows in their flight by attaching to their lower ends two feathers—one from the right wing, the other from the left wing of a bird—which acted obliquely against the air and thus imparted the rotary motion required.

CLASS B.—SERRATED EDGES. (Plate 38, figs. 1–9.)

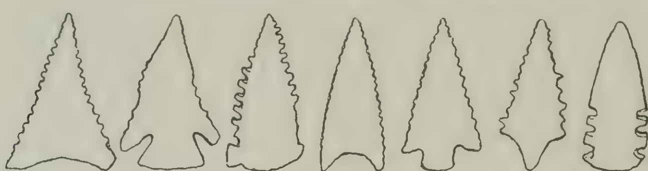


Fig. 184.

PECULIAR FORM OF ARROWPOINT, WITH SERRATED EDGES.

Oregon.

Division IV, Class B.

$7\frac{1}{8} \times \frac{3}{4} \times \frac{1}{4}$.

Cat. No. 12776, U.S.N.M.

These may be of the usual types as to form, stem, barb, etc., but the serrated edge is a peculiarity sufficiently marked to prevent their being assigned to their respective types. The edges are jagged like sawteeth, and the serrations about the same size and frequency as a moderately fine handsaw. They are not the result of hazard in chipping, but are made by pressure with a pointed flaker exerted on the edges from alternate sides and at intervals, and are done with a purpose.

Fig. 185.

PECULIAR FORM OF ARROWPOINT, WITH SERRATED EDGES.

Stockton, San Joaquin County, California.

Division IV, Class B.

$1\frac{1}{4} \times \frac{9}{16} \times \frac{3}{16}$.

Cat. No. 43029, U.S.N.M.

[1] Anthropological Review, VII, 1869, p. lxxi.

EXPLANATION OF PLATE 38.

				B.					
1	2	2	3	4	5	6	7	8	9
				C.					
19	18	17	16	15	14	13	12	11	10
				D.					
20	21	22	23	24	25	26	27		

PECULIAR FORMS OF ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class B.

Fig. 1. LIGHT-BROWN FLINT.
(Cat. No. 171437, U.S.N.M. Waynesboro, Burke County, Georgia. Dr. Roland Steiner.)

Fig. 2. YELLOWISH-BROWN FLINT.
(Cat. No. 171437*a*, U.S.N.M. Waynesboro, Burke County, Georgia. Dr. Roland Steiner.)

Fig. 3. FAWN-COLORED FLINT.
(Cat. No. 98403, U.S.N.M. Crawford County, Indiana. John H. Lemon.)

Fig. 4. OBSIDIAN.
(Cat. No. 42646, U.S.N.M. Stockton, San Joaquin County, California. L. Belding.)

Fig. 5. LIGHT-BROWN FLINT.
(Cat. No. 171437*b*, U.S.N.M. Waynesboro, Burke County, Georgia. Dr. Roland Steiner.)

Fig. 6. LIGHT-BROWN FLINT.
(Cat. No. 132199, U.S.N.M. Burke County, Georgia. McGlashan collection.)

Fig. 7. BROWN FLINT.
(Cat. No. 171444, U.S.N.M. Waynesboro, Burke County, Georgia. Dr. Roland Steiner.)

Fig. 8. BLUE-GRAY FLINT.
(Cat. No. 12776, U.S.N.M. Oregon. Paul Schumacher.)

Fig. 9. OBSIDIAN.
(Cat. No. 43029, U.S.N.M. Stockton, San Joaquin County, California. L. Belding.)

Class C.

Fig. 10. FAWN-COLORED FLINT.
(Cat. No. 21155, U.S.N.M. New Braunfels, Comal County, Texas. F. Lindheimer.)

Fig. 11. GRAY-BROWN FLINT.
(Cat. No. 61444, U.S.N.M. Austin, Travis County, Texas. George Stolley.)

Fig. 12. GRAY-BROWN FLINT.
(Cat. No. 8239, U.S.N.M. Tennessee. J. H. Devereux.)

Fig. 13. DARK SLATE-COLORED FLINT.
(Cat. No. 60459, U.S.N.M. Clinton, Feliciana County, Louisiana. John W. Roberts.)

Fig. 14. CLAY IRONSTONE.
(Cat. No. 5891, U.S.N.M. East Windsor, Hartford County, Connecticut. D. W. Wood.)

Fig. 15. BLUE-BLACK FLINT.
(Cat. No. 35302, U.S.N.M. Valley of the Ohio River. W. M. H. De Haas.)

Fig. 16. OBSIDIAN.
(Cat. No. 19610, U.S.N.M. Susanville, Lassen County, California. Stephen Powers.)

Fig. 17. BLACK FLINT.
(Cat. No. 23265, U.S.N.M. Etowah Mounds, Bartow County, Georgia. B. B. Gideon.)

Fig. 18. DARK-GRAY FLINT.
(Cat. No. 6170, U.S.N.M. Lockport, Niagara County, New York. Col. E. Jewett.)

Fig. 19. DARK SLATE-COLORED FLINT.
(Cat. No. 16682, U.S.N.M. Peotone, Will County, Illinois. D. H. Eaton.)

Class D.

Figs. 20, 23. STRAW-COLORED FLINT.
(Cat. Nos. 132235, 132226, U.S.N.M. Burke County, Georgia. McGlashan collection.)

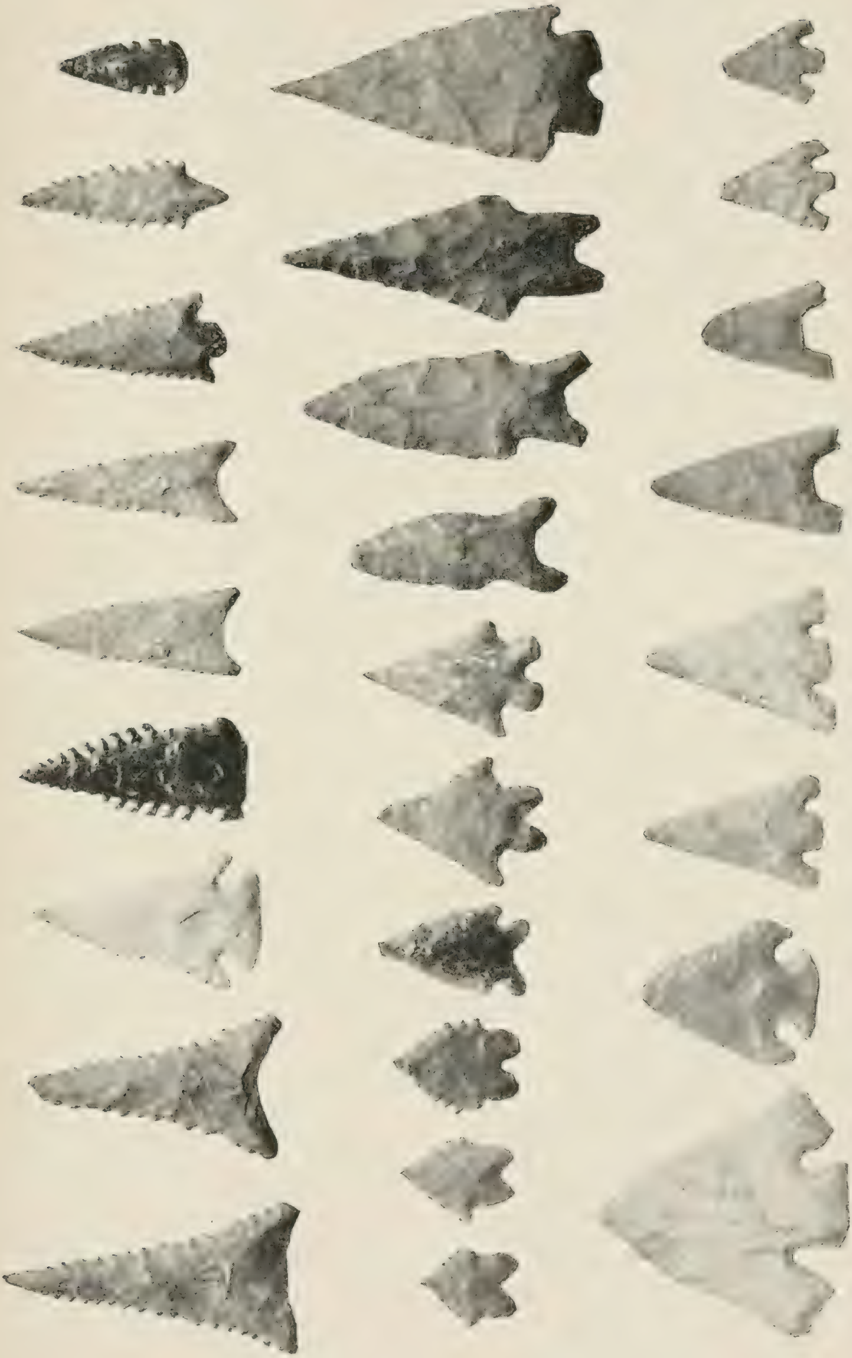
Fig. 21. YELLOWISH-BROWN FLINT.
(Cat. No. 132189, U.S.N.M. Burke County, Georgia. McGlashan collection.)

Fig. 22. FAWN-COLORED FLINT.
(Cat. No. 132189*a*, U.S.N.M. Burke County, Georgia. McGlashan collection.)

Figs. 24, 25. FAWN-COLORED FLINT.
(Cat. Nos. 9631, 9631*a*, U.S.N.M. County Derry, Ireland. R. Day, jr.)

Fig. 26. BLUE-GRAY FLINT.
(Cat. No. 11130, U.S.N.M. Scarborough, Yorkshire, England. W. A. Baker.)

Fig. 27. FAWN-COLORED FLINT.
(Cat. No. 11121, U.S.N.M. County Armagh, Ireland. W. A. Baker.)



PECULIAR FORMS OF ARROWPOINTS, SPEARHEADS, OR KNIVES.
Classes B, C, and D.

Figs. 184 and 185 are specimens of this class. Both are from the Pacific coast. The former is stemmed and shouldered, with pointed base, and would belong to Class B, stemmed; while the latter is leaf-shaped, with convex base, and would belong to Class B, leaf-shaped, but for its serrated edges. The edges of the former are serrated from the shoulder to the point; those of the latter have but three serrations near the base, but the implement is so small that slight entry into the flesh brings the serrations into use. A series of this class is represented on Plate 38, figs. 1–9.

CLASS C.—BIFURCATED STEMS. (Plate 38, figs. 10–19.)

These may be of standard types of any class of the stemmed division, either shouldered or barbed, with edges concave, straight, or convex; but, as in the class with serrated edges, here the bifurcated stem is a peculiarity so marked as to transfer it to this division (fig. 186).

Usually the bifurcated stem is neither expanding nor contracting, but is straight, with parallel edges. What would otherwise be the base is here occupied by a V-shaped notch. It is made by the same method as is the notch forming the shoulder, namely, chipping the flakes always in the same place by pressure exerted alternately from each side.

Fig. 186.
PECULIAR FORM OF ARROWPOINT, WITH BIFURCATED STEM.
Tennessee.
Division IV, Class C.
$1\frac{3}{4}$ x $1\frac{1}{4}$ x $\frac{1}{4}$.
Cat. No. 8235, U.S.N.M.

The flakes may have converted the former straight base into a V-shaped notch, which must have served for the insertion of the split shaft or handle. When shafted or handled the bifurcation would be hid, but it would seem to have afforded a firmer fastening.

From observations of specimens, it appears that arrowpoints of this size need not have been fastened firmly, but were as frequently lashed so as to wobble and possibly be detached from the shaft and left in the wound.[1]

As the only attainment of the bifurcated stem appears to have afforded a firmer fastening (which was not needed for arrows, but was for knives), it is suggested that these may have been intended for knives and not for arrows. The well defined difference between the two classes and their existence and employment

[1]Cases are cited in the works on arrow wounds where the arrowpoint, having entered the body, the forcible withdrawal of the shaft has left the head or pile in the body. Many such cases have been observed by the surgeons of the Army and reported to the Surgeon-General's Office, while the remains themselves have been sent to and are now to be seen in the Army Medical Museum.

in the same locality, with a preponderance in number of those not bifurcated, points to the same conclusion. If the shaft or handle was cut out so as to receive the stem and also to fit the bifurcation, and then pressed in hard and lashed with sinews after the manner of arrowpoints, one can easily see that the bifurcation would increase the firmness of the blade in its handle. Reference is made to Plate 38, Nos. 10–19, for other specimens.

CLASS D.—EXTREMELY LONG BARBS, SQUARE AT ENDS, FINELY CHIPPED. (Plate 38, figs. 20–27.)

These are peculiar in that they are restricted to certain localities. Sir John Evans says they are found in some parts of England and Ireland. A beautiful specimen is figured by him,[1] found by Canon W. Greenwell at Rudstone, near Bridlington, which is here reproduced as fig. 187. They much resemble the Queen's "broad arrow."

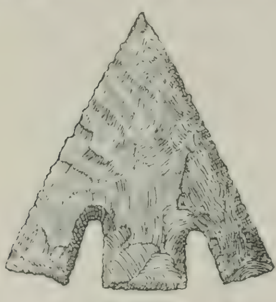
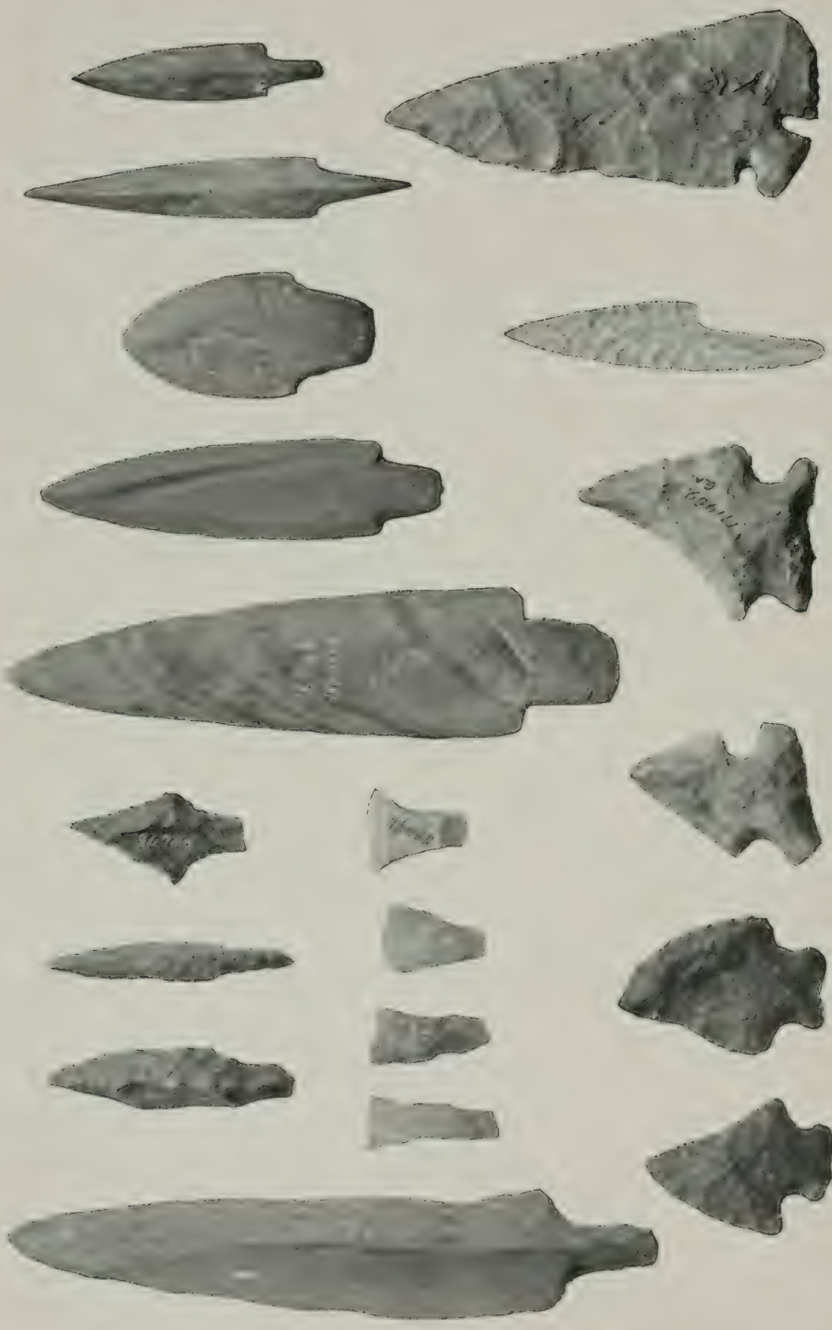


Fig. 187.
PECULIAR FORM OF ARROWPOINT, WITH EXTREMELY LONG BARBS, SQUARE AT ENDS.
Rudston, England.
Division IV, Class D.
Found by Canon W. Greenwell.

Our interest in this class arises from the fact that, while they are confined to restricted localities in Europe as mentioned, they should have appeared in America in an equally circumscribed area, namely, the State of Georgia. Figs. 20 to 23 on Plate 38 are of this class and form part of the McGlashan and Steiner collections from that State.

De Mortillet mentions them and calls them "pointes de flèche à barbelures Equarries," and assigns them to the first epoch of bronze, the Morgien. He figures one[2] in the Musée St. Germain as from the north of Ireland and collected by Sir John Evans. It has no stem, its base is concave, and the barbs are long, with parallel edges and square ends. Others, from Loir-et-Cher, have stems. The edges of the barbs are parallel and the ends are straight, but instead of being square—that is, at right angles—one is oblique inward and the other outward. Remark this difference in Figs. 20–23 of Plate 38.

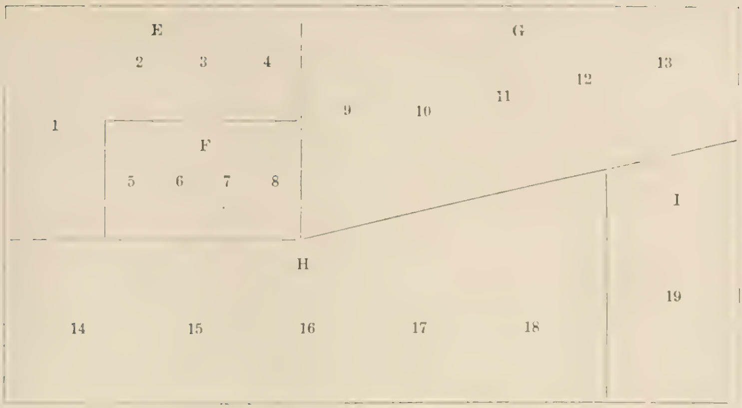
[1] Ancient Stone Implements, p. 343, fig. 318.
[2] Musée Préhistorique, pl. XLIII, fig. 373.



PECULIAR FORMS OF ARROWPOINTS, SPEARHEADS, OR KNIVES.

Classes E, F, G, H, and I.

EXPLANATION OF PLATE 39.



Peculiar Forms of Arrowpoints, Spearheads, or Knives.

Class E.

Fig. 1. Fine-grained tufa.
(Cat. No. 98478, U.S.N.M. Chiriqui, Panama, U. S. Colombia. J. A. McNiel.)

Fig. 2. Reddish jasper.
(Cat. No. 98477, U.S.N.M. Chiriqui. J. A. McNiel.)

Fig. 3. Straw-colored flint.
(Cat. No. 58489, U.S.N.M. Denmark; Royal Museum, Copenhagen.)

Fig. 4. Dark-brown jasper.
(Cat. No. 98476, U.S.N.M. Chiriqui J. A. McNiel.)

Class F.

Fig. 5. Light-gray flint.
(Cat. No. 58490, U.S.N.M. Denmark; Royal Museum, Copenhagen.)

Fig. 6. Pale-yellow flint.
(Cat. No. 149579, U.S.N.M. Loir-et-Cher, France. Thomas Wilson.)

Fig. 7. Light-gray, translucent flint.
(Cat. No. 149579*a*, U.S.N.M. Loir-et-Cher, France. Thomas Wilson.)

Fig. 8. Light-gray flint.
(Cat. No. 58491, U.S.N.M. Denmark; Royal Museum, Copenhagen.)

Class G.

Fig. 9. Gray-banded slate, oval, without ridges.
(Cat. No. 6548, U.S.N.M. St. Croix River, Maine. G. A. Boardman.)

Fig. 10. Dark-gray slate, oval, with ridges.
(Cat. No. 62097, U.S.N.M. Alaska. C. L. McKay.)

Fig. 11. Dark-gray slate, oval, with slight ridges.
(Cat. No. 30758, U.S.N.M. Seneca River, New York. W. M. Beauchamp.)

Fig. 12. Light-gray slate, with ridges, diamond in section.
(Cat. No. 140904, U.S.N.M. Korea. P. L. Jouy.)

Fig. 13. Gary flint, with ridges, diamond in section.
(Cat. No. 140904*a*, U.S.N.M. Korea. P. L. Jouy.)

Class H.

Fig. 14. Brown jasper.
(Cat. No. 35767, U.S.N.M. Haldemans Island, Susquehanna River, Pennsylvania. F. G. Galbraith.)

Fig. 15. Black flint.
(Cat. No. 6694, U.S.N.M. Berks County, Pennsylvania. G. M. Keim.)

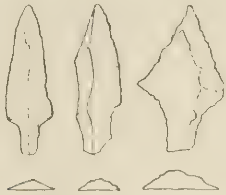
Figs. 16, 17. Light-gray flint, with straw-colored patine.
(Cat. Nos. 171459, 171459*a*, U.S.N.M. Waynesboro, Burke County, Georgia. Dr. Roland Steiner.)

Fig. 18. Flint (Solutréen point).
(Original in Museum of St. Germain. De Mortillet, Musée Prehistorique, fig. 108, pl. xviii. Grotte de l'Église (Dordogne), France.)

Class I.

Fig. 19. Blue-gray flint.
(Cat. No. 99224, U.S.N.M. San Saba County, Texas. A. R. Roessler.)

CLASS E.—TRIANGULAR IN SECTION. (Plate 39, figs. 1-4.)



These are thin and narrow rude flakes struck from nuclei and left nearly in their original condition except that a rude stem has been chipped, and where necessary they have been brought to a point. They are peculiar in being made triangular in section and that they are restricted to the province of Chiriqui, Panama. The U. S. National Museum is indebted to Mr. J. A. McNiel for its specimens, which have been described and figured by Dr. W. H. Holmes.[1]

The larger ones were of fine-grained, slaty-looking tufa, while the smaller were of flinty jasper of reddish and yellowish hues.

Fig. 188 is one of these small jasper specimens from Chiriqui. They are made entirely by chipping, and as the material is hard and refractory, the workmanship is rude. This form is shown in Plate 39, figs. 1 to 4.

Fig. 188.

PECULIAR FORM OF ARROWPOINT, TRIANGULAR IN SECTION, REDDISH JASPER.

Chiriqui, Panama, United States of Colombia.

Division IV, Class E.

Cat. No. 98477, U.S.N.M.

CLASS F.—BROADEST AT CUTTING END—TRANCHANT TRANSVERSAL. (Plate 39, figs. 5-8.)

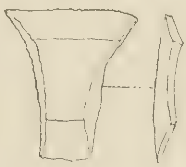


Fig. 189 (*a*, *b*) represents two specimens of this class, and figs. 5 to 8 on Plate 39 represent others. They are thin, almost flake-like in appearance, not made pointed, nor are the edges worked down by secondary chipping. The cutting edge is at the front, at the broadest end, chisel-shaped—tranchant transversal—and, thus propelled, will make a wound large enough for the arrow shaft to follow. Whether these were really arrowpoints, or were used as knives, is a disputed question. De Mortillet devotes Plate XXXIX of the Musée Préhistorique to them, showing fifteen illustrations (figs. 319-334). One of them, from Denmark, is still lashed to its shaft or handle by threads or fibers of bark. The instrument (fig. 190*a*) is small enough for an

[1] Sixth Annual Report of the Bureau of Ethnology, 1884-85, pp. 33, 34.

arrow, but the handle is short enough for a knife; whether the shaft was broken before being placed in its grave can not be known.

Fig. 190 (*b*) represents another specimen of the same class, from a neolithic grave at Montiguy-l'Engrain (Aisne) France. It is inserted in a horn handle and shows this particular specimen to have served as a knife, possibly for trepanation, and not as an arrow.

Similar specimens have been found throughout western Europe. A cache of some thousand was opened and is now displayed in the museum at Copenhagen. Another was described by M. Edmond Vielle.[1]

There is an implement peculiar to Scandinavia of the same form as the tranchant transversal. They have been called in French "tranchet." From their resemblance to the tranchant transversal they are supposed to have been the same implement and intended for the same use, but this conclusion has not been accepted. The principal difference between those of Scandinavia and of other countries is their respective sizes. Those of Scandinavia are larger, so much so as to interdict all possible use as arrowpoints or spearheads. Many of them are large enough to have required to be held in the hand for use. It is the accepted belief that they served rather as hatchets, and that their cutting was done by strokes as in chopping. It is also charged that they belonged to an earlier epoch than their smaller partners, this having been determined by the conditions and stratum of their deposit and the objects with which they were found associated. No opinion is expressed as to the correctness of this belief of the use of the tranchet. As much as can be said at the present is a warning that an objection made to the large tranchet in Scandinavia shall not necessarily defeat the ideas of the similar use for the smaller ones in France and other parts of Europe.

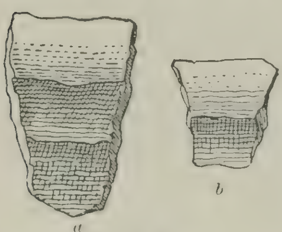


Fig. 189.

PECULIAR FORMS OF ARROWPOINTS, BROADEST AT CUTTING END—TRANCHANT TRANSVERSAL.

Aisne, France.

Division IV, Class F.

Whatever may be said in opposition to the use of the small tranchant transversal as an arrowpoint or spearhead, it must be admitted that they have been found in such numbers in numerous and widely separated localities, and extending over such an area of Europe as to make it difficult to determine for what purpose they were intended, if not for that.

The greatest contention as to its possible use grows out of its shaft or handle and the mode of attachment, by which it is sought to be determined whether it was used as an arrowpoint or spearhead, or as a knife; but all this discussion is of slight value viewed from the standpoint of this paper, for it must be admitted that these implements were prehistoric and intended for a use involving cutting, scraping, or piercing. The piercing use would decide it to be an arrowpoint or spearhead, which would naturally require an attachment to an arrow or spear shaft. But suppose that they would be found attached to a

[1] Bulletins de la Société d'Anthropologie, 1890, p. 959.

shorter shaft or handle, then they might serve as knives and as such would be entitled to consideration here. This supposed difference in the shaft or handle applies equally to other implements which have passed throughout all time as arrowpoints or spearheads. For, as has been shown in its appropriate place, the particular use of the ordinary arrowpoint or spearhead is to be determined by the kind of shaft or handle to which it was attached. The size of the implement made no difference; if it was attached to a long and stout shaft it was a spear, if to a shorter one, it was a javelin, if still shorter and smaller, an arrow, while a still shorter one became a handle and determined the implement to be a knife.

As the tranchant transversal must have had some one of these kinds of handles or shafts, the shaft or handle, and not the head, determined its use. It is therefore repeated that, in any event and without deciding the various contentions whether the tranchant transversal was used as an arrowpoint, a spearhead, or a knife, it is still appropriate to be noticed in this paper. It may have been a combination implement and served in many capacities. One suggested by the author as extremely probable is that of a surgical instrument and specially used in trepanation, of which we have seen so many instances in the prehistoric epoch to which these implements belong.

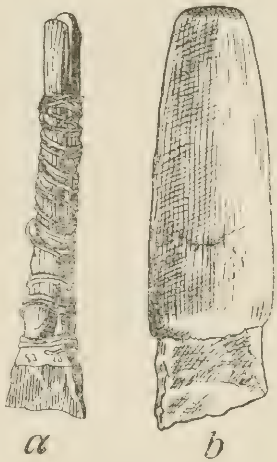


Fig. 190.

PECULIAR FORMS OF ARROWPOINTS—TRANCHANT TRANSVERSAL.

(a) Found in peat moss, Funan, Denmark, in shaft and tied with bast fiber.

Evans, Ancient Stone Implements, etc., p. 365, fig. 344.

(b) From neolithic grave, (Aisne) France, in horn handle.

Dictionnaire des Sciences Anthropologiques, p. 1065, fig. 279.

The U. S. National Museum possesses (Wilson collection) a series of these implements from the station of Teil (Loir-et-Cher, France), collected by M. A. C. Bonnet, of Paris. He has a large collection, having excavated the station and secured its entire contents. He says the station at Teil was evidently inhabited by prehistoric man for a long time. It was on the side of a hill looking toward the south, with a stream of water at the foot, and had everything to recommend it as a place of habitation. There are many localities in western Europe wherein these implements have been found, but they do not require notice or description.

A vertebra, from a grotto near Courjeonnet, in the valley of the Petit Morin (Marne), France, was pierced by a flint arrowpoint of the type tranchant transversal. The grotto in which it was found was sepulchral. All the bones were human, regularly disposed, and their anatomical relations respectively preserved. There would seem to be no doubt that this was used as a projectile. Dr. Hamy, describing the excavations at Les Eyzies in his "Paléontologie Humaine," says:

There are very small arrowpoints, triangular or flattened, filed at their extremities, which form a sharp edge. In figs. 63, 64 one of these points is shown still inserted in the lumbar vertebra of a young reindeer.

This means arrowpoints tranchant transversal, although the name had not then been given to them.

The specimens from Petit Morin confirm Hamy's opinion and the theory that they were used as arrowpoints or projectiles. A skull was found in one of the grottoes of Villevenard, where it, with the other portions of the skeleton, were in their normal position, apparently unchanged in position since the day of burial. A portion of the skull was decayed so that possible wounds were destroyed, but inside of the skull, so placed as to be impossible of entry except through the bone, were found three arrowpoints tranchant transversal. Another of these arrowpoints was found, still at Villevenard, inserted between two dorsal vertebræ. In a burial cave containing thirty subjects, all regularly disposed and the whole grave filled solid, were found no less than seventy-three arrowpoints tranchant transversal. They were disposed in the head and trunk and bore such relation to the skeletons as to show that they had been intimately associated with the body, if not inserted in it, at the time of burial. Baron de Baye found nearly two thousand of these specimens, tranchant transversal, in the grottoes explored by him, and it is impossible to believe, after the evidences found, that they had not been used as projectiles, whether as arrowpoints or spearheads may be left undetermined.

Those who are desirous of continuing the investigations into this subject are referred to the authorities:

"Sur les Flèches à Tranchant Transversal," by Baron Joseph de Baye, in Congrès International d'Anthropologie et Archaeologie Préhistoriques. Compte rendu de la 7e session, Stockholm, 1874, I, pp. 271, 272.

"Le Préhistorique," 2d ed., p. 518. By G. De Mortillet.

"Le Musée Préhistorique," pl. XXXIX, figs. 319–334. By G. De Mortillet.

"Pointes de Flèches Typiques de Fere-en-Tardenois (Aisne)," by Edmond Vielle: Bull. de la Soc. d'Anthrop. de Paris, I, (4th ser.), Paris, 1890, pp. 959–964.

"Armes de Jet à Tranchant Transversal, concave ou convexe," by Dr. L. Capitan. Bulletin de la Societe d'Anthropologie de Paris, XII (3d ser.), 1889, pp. 609–620.

"Ancient Stone Implements of Great Britain," by Sir John Evans (Amer. ed.), p. 365.

"Un Depôt de Flèches à Tranchant Transversal dans les Stations du Petit-Morin," by Baron Joseph de Baye. Bulletin de la Société d'Anthropologie de Paris, VII (3d ser.), 1884, pp. 202–204.

A communication by M. Dumont[1] argues the affirmative of the proposition at length in a very satisfactory manner. It shows, by Plate IX, that on the Kongo and throughout a large portion of Africa the arrow or spear heads with the broad points, tranchant transversal, are in continued use among the savages. The same idea is elaborated by Dr. Capitan in the study mentioned.

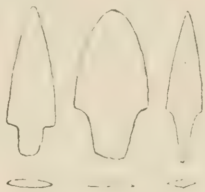
Those who are in opposition to the idea of these being used as arrowpoints are recommended to Dictionnaire des Sciences Anthropologiques, titles "Neolithique," p. 806, and "Tranchet," p. 1064, by Philippe

[1] Bulletin de la Societe d'Anthropologie, Bruxelles, VIII, 1889–90, pp. 176–188.

Salmon, and "Chisel-shaped," by Sir John Evans, Ancient Stone Implements, etc., p. 329, fig. 272 from Egypt, and p. 352, fig. 342, from Scotland.

Two ancient specimens of this type, undoubtedly used as arrows, and coming from France, are shown (figs. 196, 197) in the chapter on 'Arrow wounds,' as having been fired, the first into a human vertebra and the second into a human tibia. While the drawing of these illustrations may not represent the tranchant transversal with exactness, there is no doubt, both from description and examination, that they are of this type.

CLASS G.—POLISHED SLATE. (Plate 39, figs. 9–13.)



Specimens of this type are shown on a portion of Plate 39 (figs. 9–13). They are peculiar in that they are found and appear to have been made and used in a restricted locality on the northern Atlantic coast. They are of slate, have been ground or polished on both sides, and made to a smooth edge.

Knives of slate, with a circular cutting edge, fashioned like a saddler's knife, have been found in the same region, where they are said to have been used as fish knives. Both spearheads and knives are identical with Eskimo forms and would suggest possible contact; but it is remarkable, and as yet unexplained, why this material should have been preferred for arrowpoints or spearheads. There is no lack of the usual material in this portion of the country. Mount Kineo furnishes a porphyritic felsite (Mount Kineo flint), which was manufactured into arrowpoints that have been distributed up and down the coast for a long distance.

CLASS H.—ASYMMETRIC. (Plate 39, figs. 15–19.)

A series of asymmetric arrowpoints is represented in a portion of Plate 39 (figs. 15–19). Their lopsided form shows their peculiarity. It is curious that they should have been made in a way which appar-

ently destroys their effectiveness as a projectile. It is suggested that they may have been fastened to a short handle after the fashion of a knife and then used as concave scrapers; that is to say, for the same purpose as the implements in Plate 26. The convex edge may have been used as a knife.

The long, straight implement (Plate 39, fig. 15) is quite different from these, and yet is asymmetric and to be placed in this class. It belongs to the Solutréen epoch of the Paleolithic period and represents the earliest examples of supposed arrowpoints or spearheads, although they may have been, and probably were, used as harpoons; they come from the well-known cavern district on the Vézère (Dordogne), France. The U. S. National Museum (Wilson collection) possesses two specimens of the same style, but smaller. The Solutréen epoch was proverbial for the excellence of its flint chipping, and these are representative examples.

The Steiner collection from Burke County, Georgia, contains a number of asymmetric arrowpoints or spearheads. Figs. 16 and 17, Plate 39, and fig. 195 belong to that collection. They are of the gray flint with yellow patina so common in that country, of which we have so many representatives in the Steiner and McGlashan collections. The remark above made as to the impossibility of their use as projectiles and the probability of their employment as scrapers or knives with short handles, applies to these specimens. Others shown in the plate as belonging to this class have great similarity with the implements to be described in the succeeding chapter on knives. Their asymmetric and lopsided form, the characteristics of their point, and the sharpened edge upon the one side only, the stem suitable for handling, are all evidence of the non-employment of these implements as arrows or spears, or as projectiles.

CLASS I.—CURIOUS FORMS. (Plate 39, fig. 14; Plate 40.)

There have been discovered in different countries, implements which have resemblance to arrowpoints and spearheads in material, method and style of manufacture, and general appearance, though by reason of the peculiarity of their form are totally unfitted for any projectile purpose and, indeed, it is impossible that they should have served as such. Plate 39, fig. 14, shows one of this class, and Plate 40 represents a

EXPLANATION OF PLATE 40.

PECULIAR FORMS OF ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class I.

Fig. 1. GRAY FLINT.
(Cat. No. 43132, U.S.N.M. Mound, Naples, Illinois. J. G. Henderson.)

Fig. 2. OBSIDIAN.
(Cat. No. 26417, U.S.N.M. San Miguel Island, California. S. Bowers.)

Fig. 3. DARK-GRAY FLINT.
(Cat. No. 62387, U.S.N.M. Jefferson County, West Virginia. R. W. Mercer.)

Fig. 4. PORPHYRITIC FELSITE.
(Cat. No. 9992, U.S.N.M. Shell heaps, Edmunds, Maine. G. T. Gardner.)

Fig. 5. DARK-GRAY FLINT.
(Cat. No. 147751, U.S.N.M. Flint Ridge, Licking County, Ohio. Gerard Fowke.)

Fig. 6. PALE BROWN FLINT.
(Cat. No. 35589, U.S.N.M. Greenfield, Missouri. M. E. Harrison.)

Fig. 7. PALE-BROWN FLINT.
(Cat. No. 147750, U S.N.M. Flint Ridge, Ohio.)

Fig. 8. PALE-GRAY FLINT.
(Cat. No. 15733, U.S.N.M. San Miguel Island, California. W. G. Harford.)

Fig. 9. GRAY FLINT.
(Cat. No. 145977, U.S.N.M. Flint Ridge, Ohio. Gerard Fowke.)

Fig. 10. GRAY FLINT.
(Cat. No. 32538, U.S.N.M. Pearl Depot, Illinois. Brainard Mitchell.)

Fig. 11. GRAY FLINT.
(Cat. No 15732, U.S.N.M. San Miguel Island, California.)

Fig. 12. PINK FLINT.
(Cat. No. 32522, U.S.N.M. Pearl Depot, Illinois. Brainard Mitchell.)

Fig. 13. PALE-GRAY FLINT.
(Cat. No. 30127, U.S.N.M. St. Clair County, Illinois. Dr. J. R. Patrick.)

Fig. 14. GRAYISH FLINT.
(Cat. No. 29630, U.S.N.M. San Miguel Island, California. S. Bowers.)

Fig. 15. WHITE FLINT.
(Cat. No. 173938, U.S.N.M. Southeast Missouri. Bureau of Ethnology, Hilder collection.)

Fig. 16. WHITE FLINT.
(Cat. No. 98662, U.S.N.M. (Cast). Greene County, Illinois. C. Armstrong.)

Fig. 17. WHITE FLINT.
(Cat. No. 32523, U.S.N.M. Pearl Depot, Illinois. Brainard Mitchell.)

Fig. 18. WHITE FLINT.
(103 (?). Missouri.)

Fig. 19. WHITE FLINT.
(Cat. No. 146840, U.S.N.M. Dallas City, Illinois. L. S. Bliss.)

Fig. 20. PINKISH FLINT.
(Cat. No. 97485, U.S.N.M. Flint Ridge, Ohio. Gerard Fowke.)

PECULIAR FORMS OF ARROWPOINTS, SPEARHEADS, OR KNIVES.

Class I.

series of these curious forms. The latter is taken from the author's paper on Prehistoric Art,[1] where it is thus introduced:

It has been remarked many times throughout this paper that the prehistoric artist possessed sufficient confidence in his ability, and displayed such control over his tools and materials as enabled him to make anything out of flint that his fancy might dictate; he did not confine himself to utilitarian objects, but was an artist in the true sense of the word; that is to say, he dealt with art for art's sake, for the sake of making something which should be beautiful and whose only purpose, according to the canon of art laid down by Sir John Collier, would be to please his eye and to gratify his taste. The prehistoric artist in flint obtained, in some way, we know not how, possibly by study and contemplation, possibly by education, possibly by accident, an ideal which he reproduced in flint. Plate 29 [Plate 40] represents twenty objects taken at hazard from the interior of the United States, principally from the Ohio and Mississippi valleys, all of flint, in curious and rare forms, believed to be entirely without utility and solely to gratify an artistic desire. None of them are arrow or spear heads, and none of them appear to have been made for any service. They are the work of a master who, conscious of his ability, is playing with his art. One represents a bird, one a snake, one an outstretched beaver-skin, two of them, by stretch of the imagination, might represent four-footed animals; the rest have no likeness to any known object. All of them are worked from flint or some similar stone; one is of obsidian; they are represented about natural size. This series shows what the prehistoric artist in flint was able to do in the management and control of his tools and materials in making fanciful objects.

Fig. 191.

ARROWPOINT OF BONE, WITH NARROW GROOVES ON EACH SIDE AND SHARP FLINT FLAKES FASTENED WITH BITUMEN OR GUM.

Sweden.

Cat. No. 101637, U.S.N.M.
Natural size.

These curious forms are not peculiar to the United States. They are found in England,[2] and have also been found scattered through France, Switzerland, and Italy, though rarely.

Fig. 191 is one of the peculiar forms restricted in number and locality. Its restrictions in both these regards are so close that the author has not deemed it necessary to assign it a class or give it a name. These forms are confined to Scandinavia, and are extremely rare even in that country. The specimen figured is from Sweden, was procured by the author, and forms part of the collection in the U. S. National Museum. It is an arrowpoint of bone, sharpened to a fine point, is extremely hard and stiff, and could pierce equal to any flint weapon. Either side is opened with a deep and narrow groove into which have been inserted tiny bits of flint flakes, with sharp cutting edges, fas-

[1] Page 437, pl. 21.

[2] Sir John Evans, Ancient Stone Implements, pp. 350, 351, figs. 336–339.

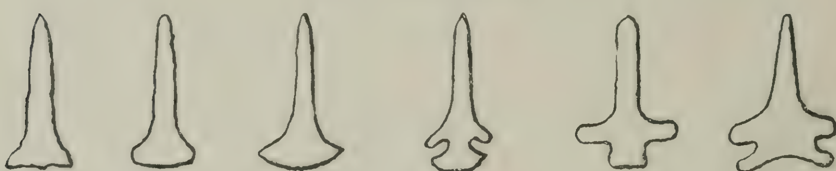
tened with bitumen or gum. Some of these bits of flint have been lost out of the original specimen, but enough remain to show its character and effectiveness as a weapon.[1] Some of the bits of flint suitable for such use have been found and are displayed in the Museum of the Royal Irish Academy.[2]

M. de Mortillet presents, in "Musée Préhistorique,"[3] eight illustrations of spear and lance heads with two poniards, varying in length. Six are from France, of which three are the flint of Grand Pressigny. He makes the following remarks as to their differentiation:

> Lanceheads and poniards of flint in France are smooth on one side, the chipping being always done on the other. In Scandinavia they are chipped on both sides. In France the objects intended for knives have no secondary chipping at all. The cutting edge is left smooth as it was struck from the core; in other words, it is simply a sharp-edged flake.

In his estimation an object from France like the Mousterien point (figs. 3, 4), untouched on one side but wrought to an edge on the other, would be a spear or lance head, while a flake like that from Grand Pressigny (Plate 7, fig. 4), sharp but untouched on the edge, would be a knife. His Plate XLII contains illustrations of javelin points, large arrowpoints, of which five are from France (four of flint and one of bone), three are from the United States, the others from Russia and Scandinavia. His Plates XLIII and XLIV contain 41 illustrations of arrowpoints, of nearly every form and style (figs. 365–405). France has 21 representatives, Italy 4, Switzerland and Denmark each 3, Ireland, Portugal, and America each 2, Prussia, Sweden, and Algeria each 1. These are of the usual types, though some may have particular forms peculiar to certain countries. His Plate XLV contains four illustrations of the mode of fastening the arrowpoints to the shaft, three from the lake dwellings of Switzerland, and one from California; two are of stone and one of bone.

CLASS K.—PERFORATORS.



An anomaly in arrowpoints should not be overlooked. One of the prehistoric implements of America is that which usually has been called the perforator or drill, though sometimes, jocularly, "hairpin." It consists of the bore or pile, which is round or nearly so, pointed as though suitable for drilling or boring, with a stem or base after the fash-

[1] Montelius, Civilization of Sweden in Heathen Times, p. 25, fig. 25.
[2] Sir W. Wilde, Catalogue of the Royal Irish Academy, I, p. 10; p. 251, fig. 163.
[3] Plate XLI.

ion of arrowpoints. It has usually been supposed that this spreading base was to be held between the thumb and fingers, gimlet fashion, and used as a drill. Some of these implements appear to have been made primarily for this purpose, while others have the full and complete base, stem, shoulders, and sometimes barbs, of the stem end of an arrowpoint, and of these it has always been said or supposed, that the perforator or drill had a secondary use, and was possibly a broken arrowpoint. The blade is chipped away on either edge until the pile or bore is very nearly round and quite pointed. These have never been classed as arrowpoints or spearheads, but it is curious to remark that the only wounds shown in the two human skulls in the U. S. National Museum should have been made by stone implements or arrowpoints of this peculiar kind. Reference is made to figs. 198 and 200, where the skulls are represented with the wound and weapon as originally found, but the latter are also withdrawn and shown in their entirety. With this apparently conclusive evidence of their use as arrowpoints, they can not be omitted from this classification.

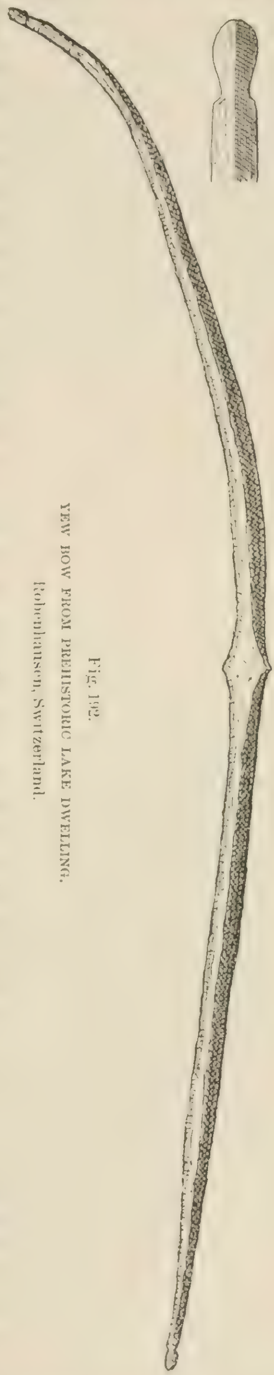


Fig. 192.

YEW BOW FROM PREHISTORIC LAKE DWELLING.

Robenhausen, Switzerland.

The bow and arrow as a projectile engine comprises several parts. This paper has treated only one, the arrowpoint or pile, as it is called in archery, for the reason that the investigation has been confined in point of time to the prehistoric, and all or nearly all parts of the engine, except the stone arrowpoint, have decayed or been destroyed by lapse of time. Bows with their strings, arrow shafts with their feathering, spear shafts, and, with a few excepted illustrations to be given, knife handles, have all perished. Dr. Otis T. Mason says:[1]

> Of the ancient inhabitants of this continent the perishable material of arrows constituting the shaft and other parts has rotted and left us naught but the stone heads. Even those of bone and wood and other material have passed away, so as to leave the impression that the Indians of this eastern region used only stone; but all authorities agree that other substances were employed quite as frequently as the last named.

[1] North American Bows, Arrows, and Quivers, Smithsonian Report, 1893, p. 654.

A single specimen of a bow was preserved in the bog peat of the lake dwellers and has been found and exhibited to the eye of man—"only this, and nothing more." Fig. 192 represents the original of this specimen, now in the museum in Zurich, Switzerland, and found by Jacob Messikommer in the peat bog which was originally the lake dwelling of Robenhausen. The author has visited this station more than once and has found many pieces of wood well preserved. The piles themselves in this, as in all other pile dwellings, are of wood, and almost every museum possesses specimens in certain stages of preservation. The work on this specimen identifies it specifically as a bow. The end "horns" show the notch for the retention of the bow string, while the center has a certain style of decoration.

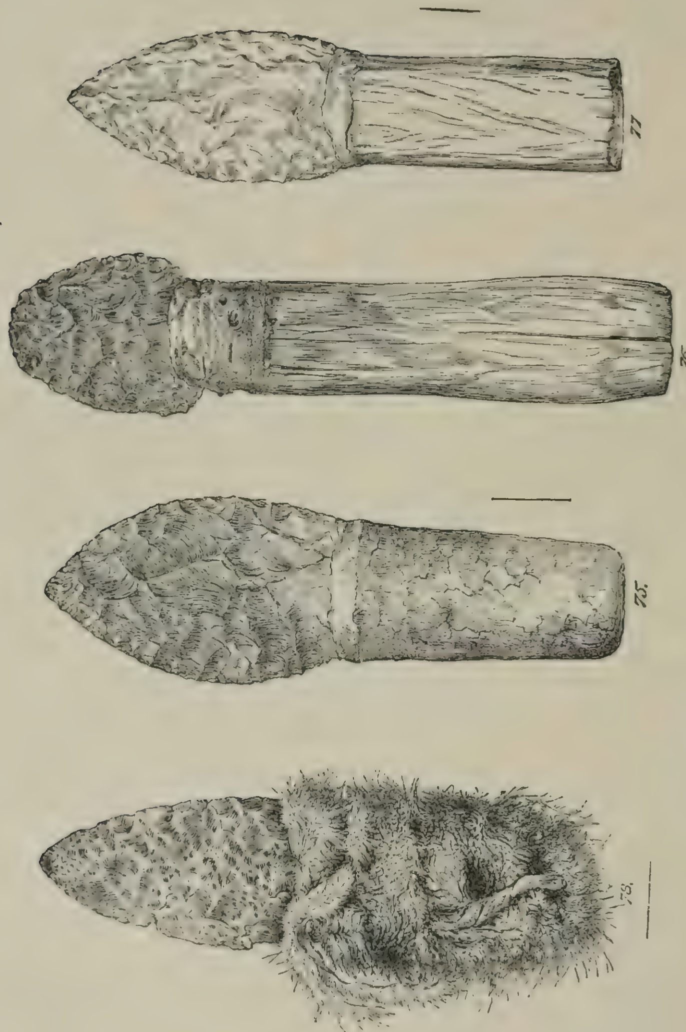
Those interested in ancient bows, or bows of primitive, not prehistoric, peoples are referred to Doctor Mason's paper.

IX. KNIVES.

Mention has previously been made of the possibility of the use by prehistoric man of the implements described in this paper for other purposes than as arrowpoints or spearheads (pp. 823, 935, 938, 977). The importance of the subject requires further investigation.

Reference to the classification of these implements will show many varieties, such as leaf-shaped, triangular, stemmed, notched, shouldered, and barbed, yet all these are variations only in details, the general form, the material, and the processes of manufacture being the same. The principal differences between the various kinds, those most affecting their use and purpose, are in size and weight. It seems strange that implements of such similarity in all functional characteristics should differ so much in size and weight, and it is unreasonable to believe that implements of such extremes—one very light and small, the other large and heavy—could have been employed in the same manner or have served the same purpose. It would indeed be strange if implements 15 or more inches long, as the Arvedsen specimen (Plate 65), or those in Plates 61 and 64 in this paper and Plate 27 in "Prehistoric Art," over 12 inches in length, should have been employed in the same manner and for the same purpose as the small obsidian or jasper "jewel points" from California and Oregon. Yet these are of the same material, have the same style and mode of manufacture, their principal, if not their only, difference being in size and weight.

These implements, with their extreme variations, are not confined to any particular locality or country. The large, finely wrought, leaf-shaped blades have been found in Mexico as well as in central France,



FLINT AND OBSIDIAN LEAF-SHAPED BLADES, HANDLED AS KNIVES.

Hupa Valley, California.

U. S. National Museum.

and the small "jewel points" are found in California and Oregon as well as in Italy, with a sprinkling of each scattered over western Europe.

The handle or shaft to which these implements were fastened and with which they were used may assist us in their classification. Imagine a hickory sapling 10 or 12 feet long, which can best be understood by the average American boy when described as a "hoop-pole," cut, smoothed, seasoned, toughened, or hardened by fire, 1½ inches in diameter at the butt and tapering to a half or three quarters of an inch at the top, into which one of the small jewel points had been inserted. This implement, held in the hands and used for thrusting, would undoubtedly be called a spear or lance. If the length of the handle was reduced to 4 or 6 feet, it would be a javelin suitable for throwing; with a light reed or cane shaft 2 or 3 feet in length it would be an arrow; and with a handle, however large, if but 3 or 4 inches in length, the implement would become a knife (Plates 41–43). The same classification applies to a larger implement attached to a larger or longer shaft equally well as to the smaller implement with the shorter shaft.

The foregoing in its application to prehistoric implements is, to a certain extent, theoretical, for their shafts or handles were of wood and by lapse of time have decayed and are lost. We know this as a matter of fact. Among the hundreds of collectors throughout the United States, where tens of thousands of ancient arrowpoints and spearheads have been collected, we have no record of any of them having been found with handle or shaft attached. This is not strange nor is it peculiar to these implements. The polished stone hatchets doubtless had wooden handles, yet of all of the thousands found, there have been less than a dozen reported in the United States with their wooden handles.[1] Like the arrowpoint or spearhead, it is usual to find them without any trace of a handle. Objects of wood used in prehistoric times have rarely been found, and the instances thereof are usually confined to those either protected by water[2] or those in the sandy desert, where there was no moisture to cause decay.[3]

There are some of these implements with their handles which, being found under these favorable conditions, or belonging to modern savages, have been preserved for inspection. Col. P. H. Ray, in his investigations and collections among the Hupa Indians,[4] reported a number of leaf-shaped implements, which, if found alone, would have passed for spearheads, as have thousands of others of similar form collected throughout all that portion of the world occupied by prehistoric man. The implements found by Colonel Ray are now in the U. S. National Museum under Professor Mason's charge (Plate 41).

[1] Thomas Wilson, Prehistoric Art, frontispiece and pl. 31.

[2] Page 946, fig. 192.

[3] The Coptic tapestries were buried in the Egyptian sands in the first to seventh centuries A. D. They have been found in this century in fairly good condition.

[4] Smithsonian Report, 1886, p. 222.

The first series consists of eight specimens. The material is obsidian or chalcedony varying from dark-brown to a dull blue, with veins of blue throughout the brown. The blades vary from 4 to 5¾ inches in length, from 1⅜ to 2⅜ inches in width, and are from ⅜ to ½ inch thick. Handles of pine, from 4½ to 6¼ inches, were attached to all of them. Five of these were glued or gummed, three were lashed. Another of these blades, similar in all respects to the former, was obtained by Colonel Ray, but the wooden handle was replaced by a wrapping of otter skin. The blade is 7¼ by 1⅞ by ⅝ inches. Specimens of the foregoing are set forth in Plate 41, a reference to which will make the description clear. The smaller specimen in this plate represents a series of knives obtained by Maj. J. W. Powell from the Pai Utes. The latter is described and figured by Dr. Charles Rau,[1] who says:

Collectors are ready to class chipped-stone articles of certain forms occurring throughout the United States as arrow and lance heads, without thinking that many of these specimens may have been quite differently employed by the aborigines. Thus the Pai Utes of Southern Utah use to this day chipped-flint blades, identical in shape with those that are usually called arrow and spear points, as knives, fastening them in short wooden handles by means of a black substance. Quite a number of these hafted flint knives (fig. 1) have been deposited in the collection of the National Museum by Maj. J. W. Powell, who obtained them during his sojourn among the Pai Utes. The writer was informed by Major Powell that these people use their stone knives with great effect, especially in cutting leather. On the other hand, the stone-tipped arrows still made by various Indian tribes are mostly provided with small, slender points, generally less than an inch in length, and seldom exceeding an inch and a half, as exemplified by many specimens of modern arrows in the Smithsonian collection. If these facts be deemed conclusive, it would follow that the real Indian arrowhead was comparatively small, and that the larger specimens classed as arrowheads, and not a few of the so-called spear points, were originally set in handles and were used as knives and daggers. In many cases it is impossible to determine the real character of small leaf shaped or triangular objects of chipped flint, which may have served as arrowheads or either as scrapers or cutting tools, in which the convex or straight base formed the working edge. Certain chipped spearhead-shaped specimens with a sharp, straight, or slightly convex base may have been cutting implements or chisels. Arrowheads of a slender elongated form pass over almost imperceptibly into perforators, insomuch that it is often impossible to make a distinction between them.

Another series of similar implements (Plate 42) with handle attached are in the U. S. National Museum. They are from southern California, and are reported in Wheeler's Geographical Survey.[2] These specimens were collected by Mr. Shumacher from Santa Barbara and Santa Cruz islands. The material, while differing much, was uniformly of hard stone, such as flint, chalcedony, or jasper. The blades are inserted in redwood handles, fastened with gum or bitumen, and bear the evidence of long exposure. The dryness of the country whence they came was probably the cause of their preservation.

These wooden-handled knives were not confined to the coast nor,

[1] Archæological Collection of the U. S. National Museum, p. 2, fig. 1.

[2] George M. Wheeler, United States Geographical Surveys West of the 100th Meridian, VII, 1879, Archæology, p. 59.

LEAF-SHAPED FLINT BLADES, IN W

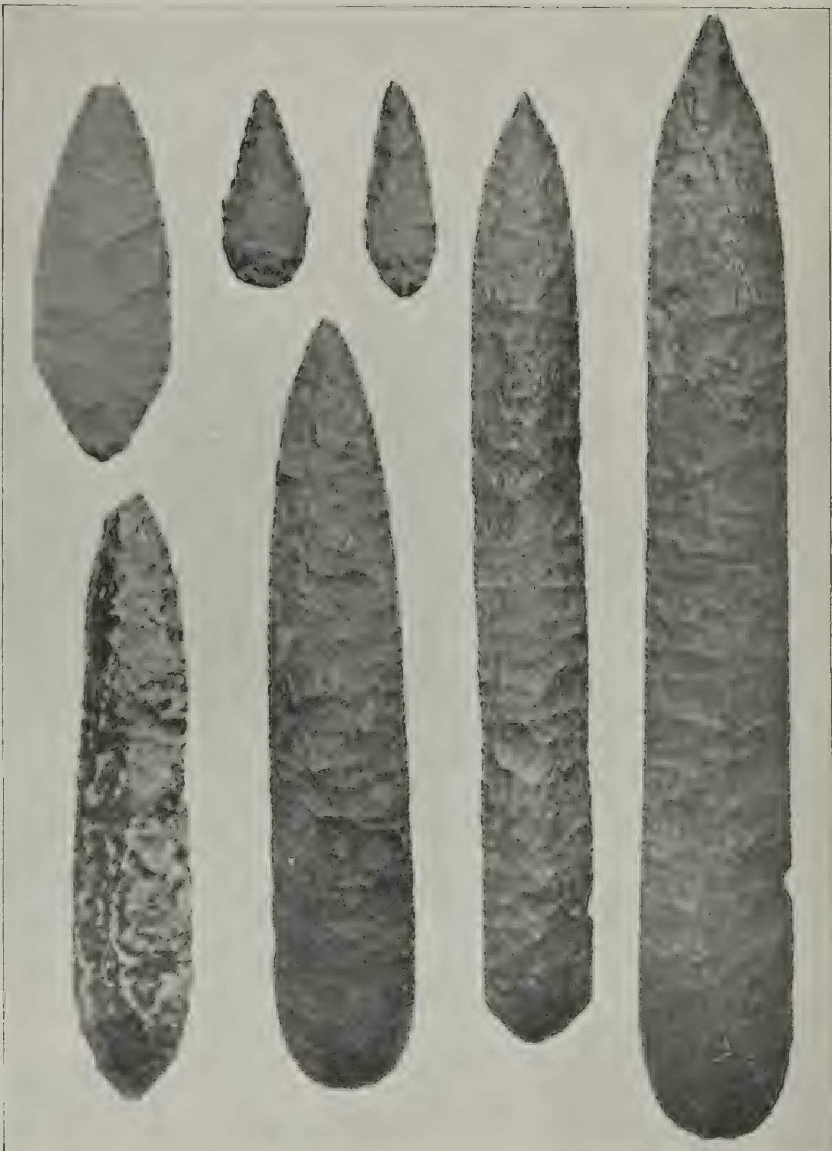
Santa Barbara and S

Wheeler's Surv

EN HANDLES, FASTENED WITH BITUMEN.

a Cruz islands, California.

etc., VII, p. 59, pl. IV.



LEAF-SHAPED BLADES OF FLINT AND CHALCEDONY, SHOWING BITUMEN HANDLE FASTENING.
California.
Wheeler's Survey, etc., VII, pl. 1.

indeed, to California, but were found far in the interior. The Hazzard collection from the cliff ruins of Arizona and New Mexico, now in the Archæological Museum of the University of Pennsylvania, which made such a memorable display at the World's Columbian Exposition in Chicago, contains a series of similar knives of flint inserted in wooden handles from 4 to 6 inches in length, of the same style and kind as the California specimens in Plate 42.

Forming part of the same series are eleven other specimens without handles, but with the traces of bitumen on the base showing where a handle had been attached. It should not be forgotten in considering these implements that they come from a country which abounds in the ordinary arrowpoints and spearheads of all kinds and sizes, some of which show extremely fine chipping.

There is still another series[1] (Plate 43) quite different in form and make, but to which the same remark applies. Some of them represent the highest order of flint chipping. They form Class C of the division of leaf-shaped implements of the author's classification. They are long, thin, and narrow, with a well-wrought base which may be square, convex, or concave, while the point is sharp and symmetrical. The peculiarity which determined their classification was the parallelism of their edges throughout their length. An inspection of the specimens renders it evident that they were never intended as arrowpoints or spearheads. Their extreme thinness, together with the breakable character of the flint of which they are made, would cause them to break in any shock that might be given by throwing, lancing, or shooting. Those of the series with convex bases are covered with asphaltum or bitumen for 1 or 1½ inches of the base. This is evidence of their insertion in a handle, which, in view of the circumstances, and their association with the former specimens, we can only conclude was short, and that the implement was intended to be held in the hand and used as a knife or dagger.

Flint or chert points similar in every way to arrowpoints, and inserted in short antler handles, were found by Prof. F. W. Putnam and Dr. C. L. Metz in their excavations of the Mariott mound in the Little Miami Valley, Ohio.[2] Ten or a dozen of these knife handles were found, in one of which was inserted a bone instead of a stone blade.

In the Swiss lake dwellings small polished stone hatchets or chisels are frequently found inserted in short antler handles. Many of these antlers were tenoned for insertion in a heavy wooden handle, evidently for use in chopping, as an ax,[3] but many of the antler handles were without tenons, and were evidently intended to be held in the hand and used as knives or chisels and not as axes.[4]

Flint or chert arrowpoints, inserted in short wooden handles for use as knives, are found in the ancient tombs of Peru. Sharpened and barbed

[1] George M. Wheeler, United States Geographical Surveys West of the 100th Meridian, VII, 1879, Archæology, pl. I.

[2] Eighteenth and Nineteenth Annual Reports of the Peabody Museum, 1886, p. 457.

[3] De Mortillet, Musée Préhistorique, pl. XLVIII.

[4] Idem., pl. LII, fig. 487.

points of bone and of ivory, inserted in short handles of wood, bone, and ivory, the lower end pointed for insertion in a lance shaft for use as harpoons, are in common use among the modern Eskimos. This short handle can be detached, thus making, if need be, a knife of the implement.

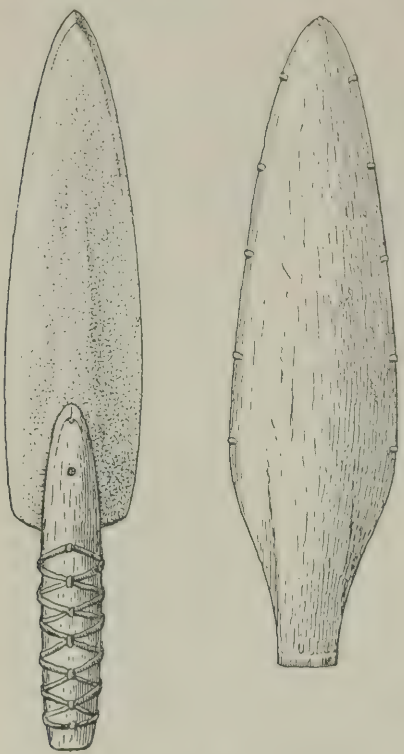


Fig. 193.
ESKIMO KNIFE WITH NEPHRITE BLADE, IVORY HANDLE, AND WOODEN SHEATH.
Norton Bay, Alaska.
Blade, 8½ x 2¼ inches.
E. W. Nelson. Cat. No. 176072, U.S.N.M.

An illustration of large blades, more or less leaf-shaped, and which, if alone, would be taken for spearheads, is shown in fig. 193, where such an implement of nephrite, beautifully wrought and finely polished, is inserted in a short handle, evidently for use as a knife. The illustrations, shown in Plate 44, of Eskimo specimens from Hotham Inlet, Alaska, collected by Lieut. Commander G. M. Stoney, U. S. N., are still more pertinent. Figs. 1 and 2 have blades of chert or hornstone of the usual leaf shape. Fig. 2 is handled for use as a knife by being inserted edgewise in a handle of wood. Fig. 1 is interesting, for its leaf-shaped characteristics are more easily identified, while its handle, instead of being of wood or fastened with bitumen or asphaltum, as have been nearly all others, is made of osier wrapped back and forth over a part of the upper edge of the blade, catching upon the irregularities of the flint edge and drawn tight so as to be held firmly in place. This was used as a fish knife, its interstices being yet filled with fish scales. Dr. Mason,[1] describing this instrument, says:

> There are thousands of pieces of shale, slate, quartzite, and other stones in the National Museum, which correspond exactly with the blades of the Eskimo woman's knife. These have been gathered from village sites, shell heaps, the surface of the soil, from graves, mounds, and Indian camps in countless numbers. * * * In the matter of attaching the blade to the handle or grip the Eskimo's mother-wit has not deserted her. Many of the blades are tightly fitted into a socket or groove of the handle. Boas, who lived among the Cumberland Gulf Eskimos, tells us that glue is made of a mixture of seal's blood, a kind of clay, and dog's hair. (Report of the Bureau of Ethnology, VI, p. 526.)

[1] The Ulu, or Woman's Knife, of the Eskimo. Report U. S. National Museum, 1890, pp. 411–417.

EXPLANATION OF PLATE 44.

Fig. 1. WOMAN'S KNIFE (Ulu). Blade of hornstone, leaf-shaped, with a projection from one margin. The handle is of the most primitive character, being formed of osier, wrapped backward and forward longitudinally, and held firmly in place by cross twining and weaving of the same material. The interstices are filled with fish scales. Length, $3\frac{3}{4}$ inches.

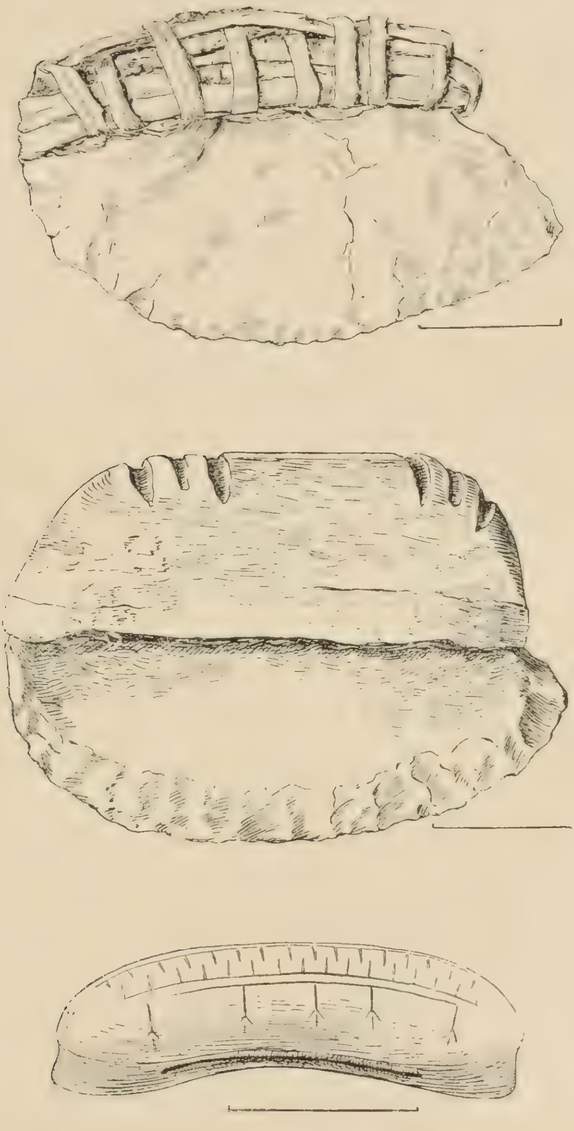
(Cat. No. 63765, U.S.N.M. Eskimo of Hotham Inlet, Alaska. Collected by Lieut. G. M. Stoney, U. S. N.)

Fig. 2. WOMAN'S KNIFE (Ulu). Blade of chert or flint material, inserted in a handle of wood. On the upper margin of the latter at either corner are three cross gashes or grooves.

(Cat. No. 63766, U.S.N.M. Eskimo of Hotham Inlet, Alaska. Collected by Lieut. G. M. Stoney, U. S. N.)

Fig. 3. WOMAN'S KNIFE (Ulu). Handle of walrus ivory. Ornament, groove, and herringbone on top; lines and alternating tooth-shaped cuts on the side, with five scratches resembling inverted trees. Pocket groove for blade, abruptly wedge-shaped, like the kernel of a Brazil nut. Length, $2\frac{1}{2}$ inches.

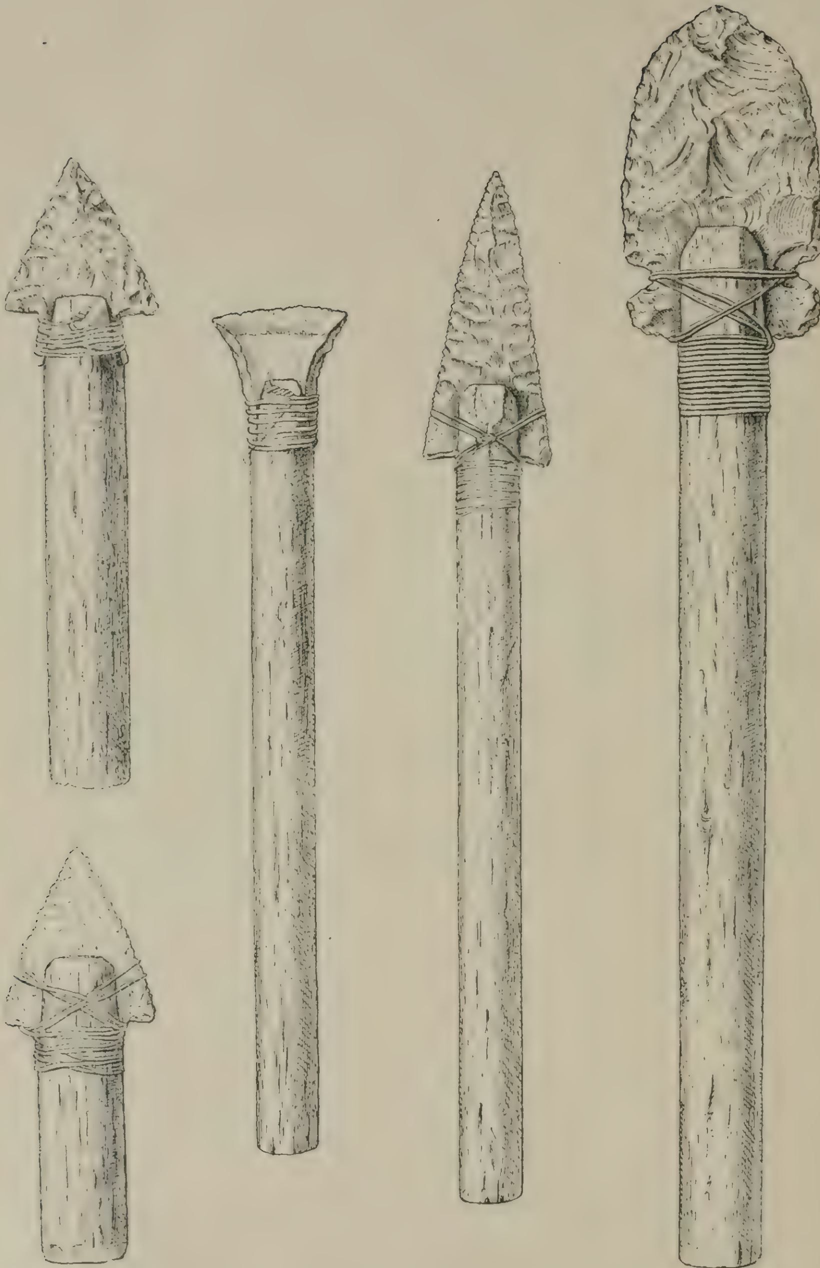
(Cat. No. 44598, U.S.N.M. Eskimo of Cape Nome, Alaska, 1880. Collected by E. W. Nelson.)



ULU OR WOMAN'S KNIFE.

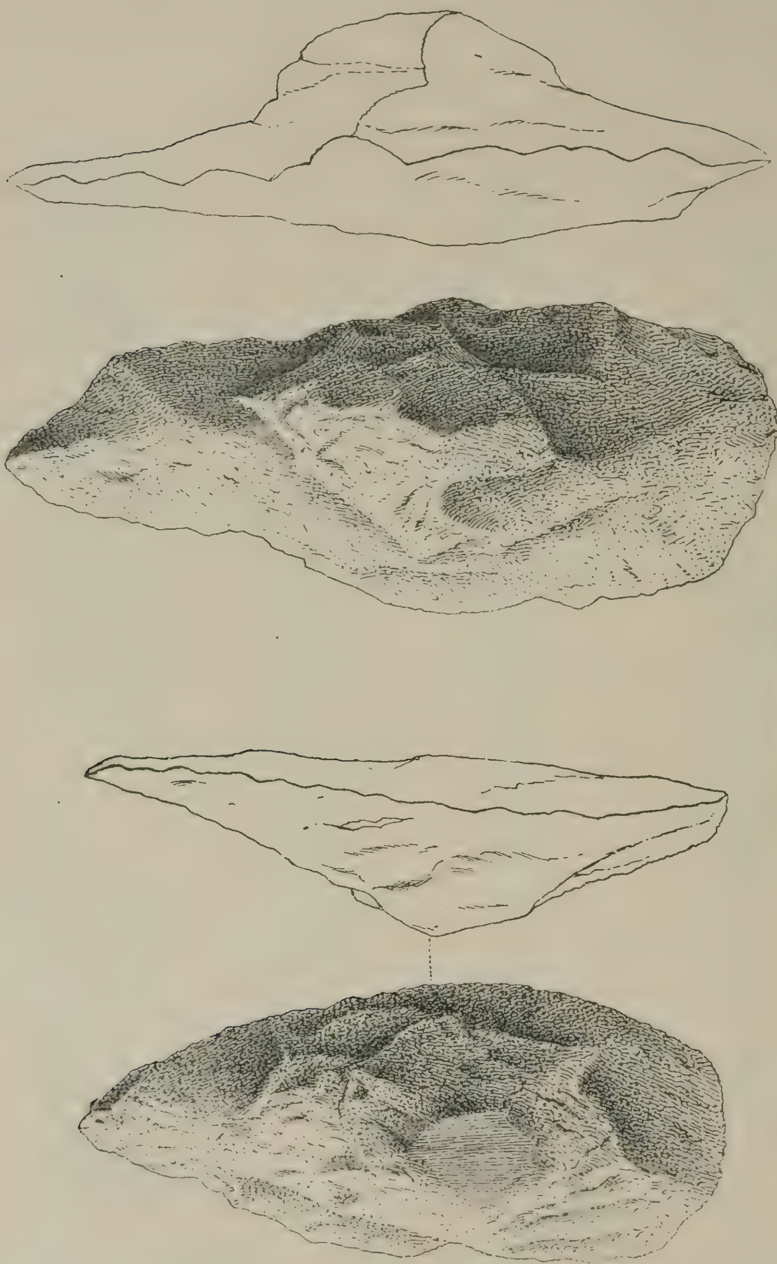
Hotham Inlet and Cape Nome.

Mason, Report U. S. National Museum, 1890, pl. LXI.



COMMON ARROWPOINTS, HANDLED BY THE AUTHOR TO SHOW THEIR POSSIBLE USE AS KNIVES.

U. S. National Museum.



HUMPBACKED KNIVES.

Side and edge views.

District of Columbia, United States, and Somaliland, Africa.

Cat. Nos. 195900, 195398, U.S.N.M.

HUMPBACKED KNIVES.

Side and edge views.

United States.

Cat. Nos. 171487, 1073, U.S.N.M.

Fig. 3 in this plate represents a handle for a similar blade, which is, however, missing. It is made of walrus ivory, the groove in which the blade has been inserted being plainly seen.

Fig. 194 represents one of the thin leaf-shaped blades from Wyoming. It is of agatized wood, is very thin, and has been finely chipped. One edge is more convex than the other and is much the sharper. Compared with the Ulu knife (Plate 44, fig. 1), no reason appears why a similar handle would not make it the same knife.

Plate 45 shows a series of common arrow or spear heads which have been inserted and wired in handles by the author. The handles vary from 6 inches in length down. They are intended to illustrate the proposition which has been herein presented—that with long handles they are arrows, with longer handles they become spears, while with short handles they become knives, and the distinction is only recognizable by the handle.

Fig. 194.

LEAF-SHAPED BLADE OF AGATIZED WOOD.

Wyoming

Natural size.

No attempt has been made in the foregoing arguments to show a difference, except in the handle, of the implement used as a spear or arrow and its use as a knife. The announcement is made as a working hypothesis that the average stone arrowpoint or spearhead collected throughout the country as an Indian implement or weapon may have been either spear, javelin, arrow, or knife, dependent upon the kind of handle employed.

There are other implements of the same material and manufacture, but with variations of form, which are not, and were never intended to be, arrow or spear heads. These, when viewed in profile from either the side or edge, show that they could not have served as piercing implements or weapons. Their edges are on the sides and not at the points, and they could only have been used for cutting and not for piercing, and were, therefore, knives. Plates 46 and 47 present specimens of this class. They are here presented in side and edge views to show this peculiarity, for viewed from the side only they appear as ordinary leaf-shaped implements worked all round to an edge. The points are not sharp, and it is doubtful if they could ever pierce any resisting substance, projected with whatever force. The impossibility

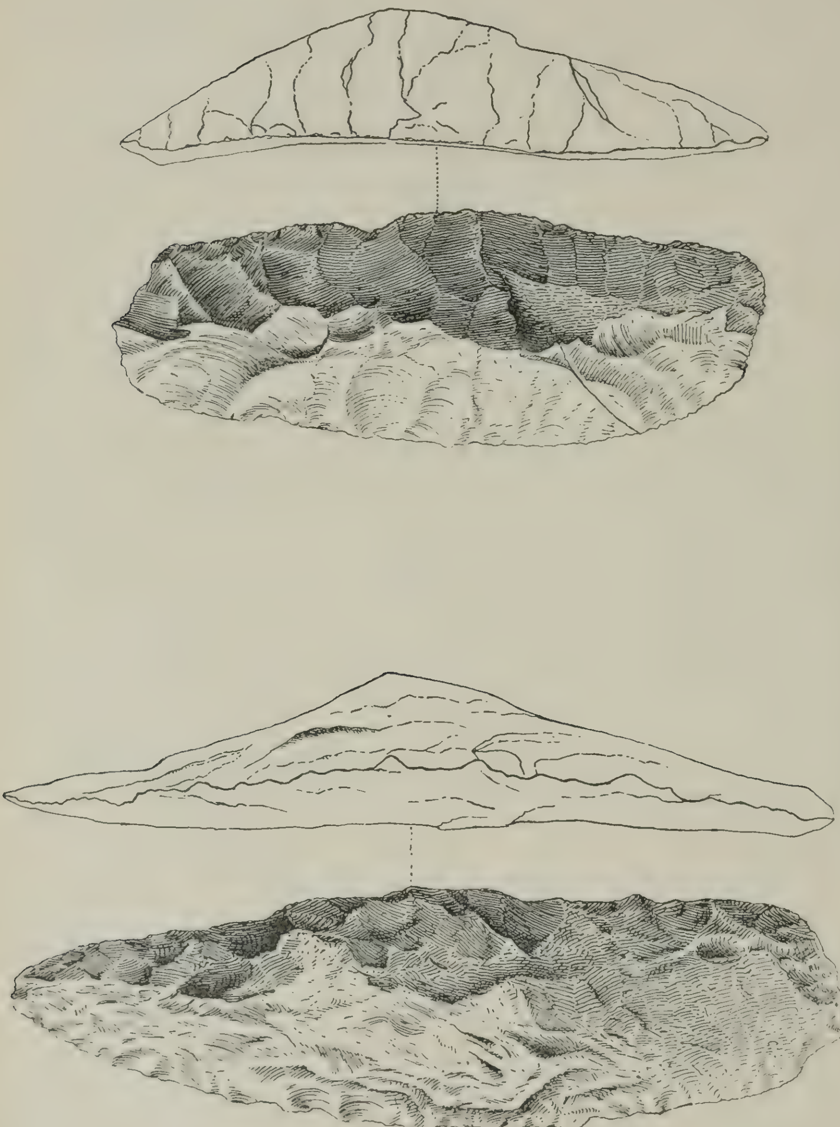
of their use in this manner becomes more apparent when the edge view is considered. This shows the want of symmetry in the implement and completely changes the idea presented by the side view. There is on the top, if one may so call it, a decided hump, and, for want of a better name, these implements have been called "humpbacked." One of them is the chalcedonic flint, while the other three are quartzite. They are rude and have all been made by chipping. Each implement has only one rounded edge sharp enough for use, and could be used when held in the hand after the manner of the fish knife (Plate 44, fig. 1).

The manner of holding these humpbacked implements for use is shown in Plate 48, where two of them are held in the hand so as to present the cutting edge. This (in Plate 48) leads to another hypothesis, that is, that these implements were used ambidextrously, and furnish evidence of right- and left-handedness on the part of prehistoric man. It is certain that the shape of an occasional implement fits the left hand better than it does the right. Certain specimens show this more or less plainly. Their humps are not in the center but off to one side, sometimes to the right, other times to the left, while the experiment of grasping them in the hand (as shown in Plate 48) demonstrates that they are more easily manipulated and more effective when used right and left handed respectively, than when used indifferently.

It has been suggested that these implements were only accidents or failures made by the aboriginal workmen when endeavoring to make the usual leaf-shaped implement, but such is not regarded as a correct deduction.

It would be foolish to assert that there were no accidents or failures in the prehistoric quarry or workshop. The author has shown in Plate 63, the chips and débris which he personally took from Flint Ridge, Ohio. Anyone having the slightest familiarity with such work has seen and will recognize thousands of such specimens. At Piney Branch, District of Columbia, they were to be numbered by the hundreds of thousands and to be measured by the ton. But it is equally daring to assert that everything found was an accident or failure, and that implements with the specialization of these now under discussion were but waste, the débris and rejects of the workshops and the accidents or failures of the workmen. Their number is too large, their dissemination too general, their distribution too extensive, and their specialization and adaptability too evident to permit such a conclusion to pass unchallenged. The evident existence of an intentional cutting edge around one side of the oval can not be ignored, while their fitness to either hand, as shown in Plate 48, and their adaptability for use as knives or for cutting purposes, are evidences against the reject or waste theory that can not be set aside by mere declarations, however persistently or pertinaciously made. No reason is, or, I take it, can be given why the workman, having gotten his implement into its present humpbacked condition, should not have continued his work by striking off

MANNER OF HOLDING "HUMPBACKS" FOR USE AS KNIVES.



"HUMPBACKS" CHIPPED SMOOTH, SHOWING INTENTIONAL KNIVES.

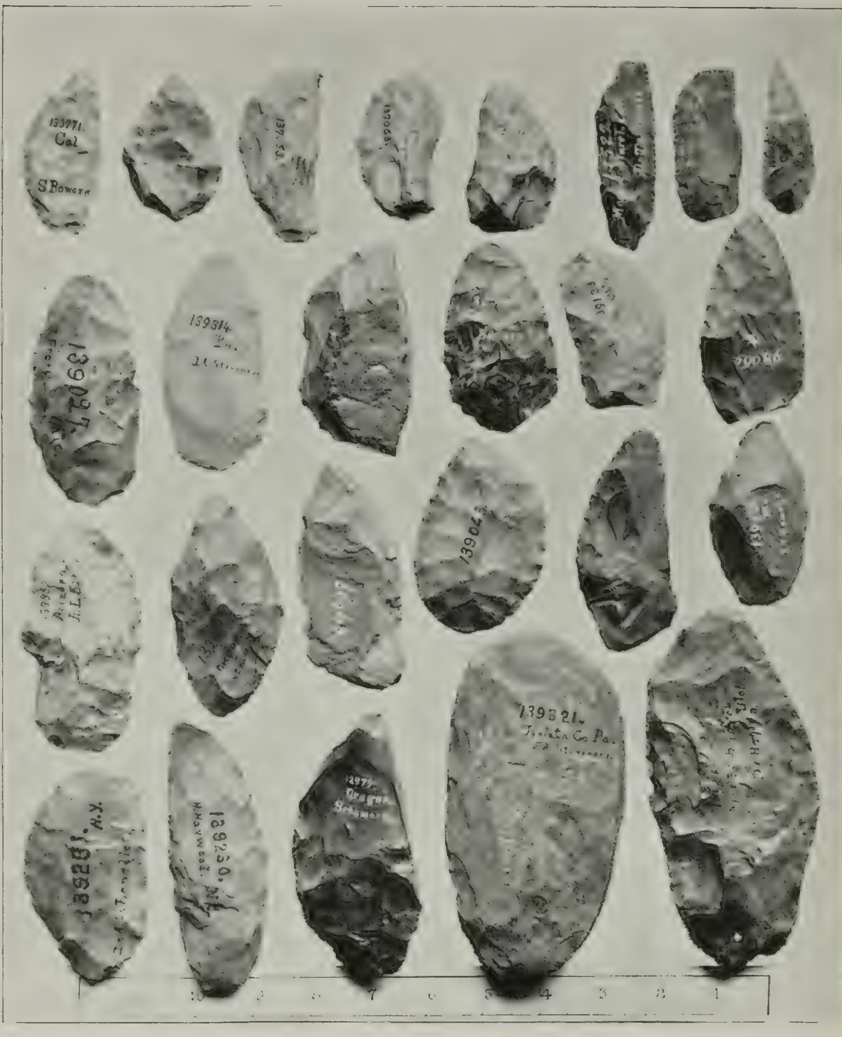
United States.

Cat. Nos. 138985, 171487, U.S.N.M.

"HUMPBACKS" OF QUARTZITE WITH ONE CUTTING EDGE, USED AS KNIVES.

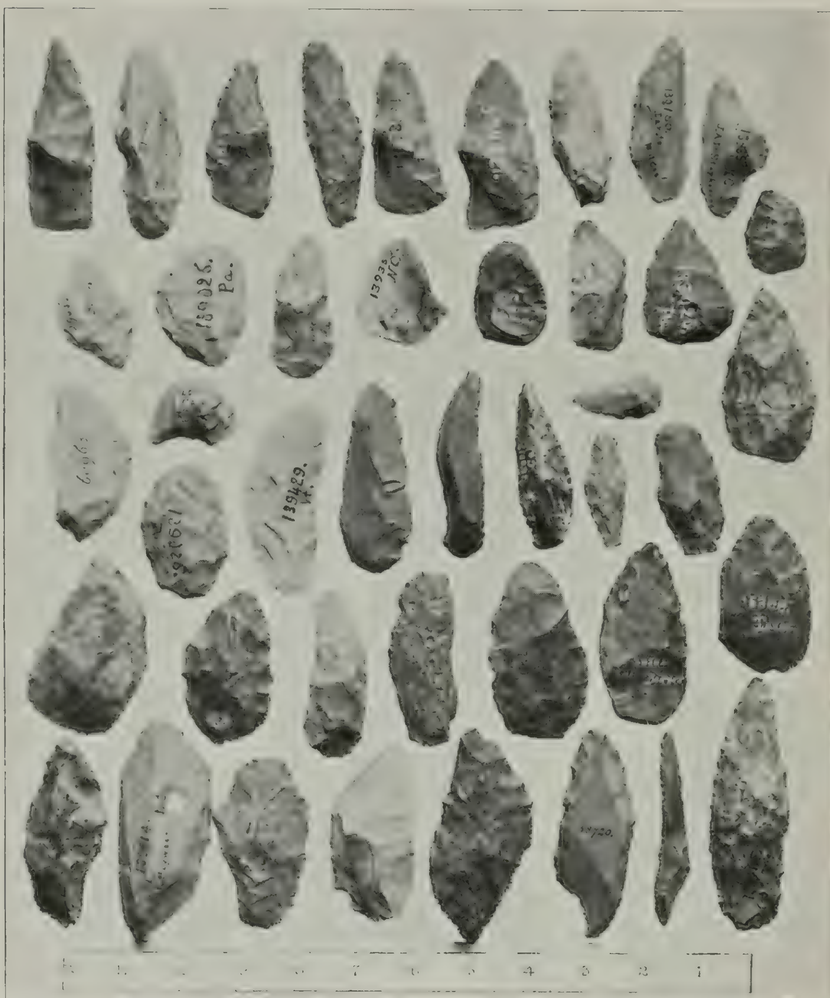
United States.

Cat. No. 1390081, U.S.N.M.



RUDE KNIVES OF FLINT AND HARD STONE, CHIPPED TO A CUTTING EDGE ON ONE SIDE OF THE OVAL.

United States.



RUDE KNIVES OF FLINT, JASPER, ETC.

Some in flakes, chipped to a cutting edge on side of oval; some have a well-developed hump.

United States.

the hump if he desired it to be stricken off, either with a direct stroke of the hammer or by the mediation of a punch, thus reducing its thickness and making it the usual leaf-shaped implement. The conclusion seems inevitable that his failure to do this is evidence of the want of his desire to do so, and that he left it thus—specimens being found throughout the country—is evidence that he desired to make a different implement from the leaf-shaped. This different implement was for cutting and not for piercing, was to be held in the hand and not used as a projectile, and finally is a knife and not an arrowpoint or spearhead.

Detailed examination confirms the view that these implements were intentionally manufactured and were not mere accidents or failures. Plate 49 represents two of these humpbacked implements, side and edge views. From these it is evident that the making of the hump is intentional. Not only is the hump recognized and permitted, but it has been adopted and treated accordingly. It has not here been left rude or unseemly, but has been carefully smoothed by chipping over its entire surface, the hump being as well preserved as in the rudest specimens. The specimens in this plate are both of flint, one from Wisconsin, the other from Georgia; both are flat on the bottom, rounded on top, and brought by chipping to a sharp cutting edge and without point. If these two specimens were the only ones thus treated, their evidence would be insufficient, but the Museum possesses numerous examples of the same kind which tend to prove the same fact. Plates 50 to 52 present some of these specimens, and a comparison will show the similarity. Their number shows that those in Plate 49 are not isolated specimens, while their number and extensive distribution throughout the country demonstrates their common use as one of the tools or implements belonging to the prehistoric culture of the country. These plates are intended also as evidence of the major proposition—that is, that many of the flint and other objects heretofore classed as arrowpoints or spearheads were really knives. These implements have no sharp points and could never have served for any piercing or thrusting purpose, but, on the other hand, have been made sharp on one, rarely on both edges, and could have been used only for cutting. The cutting edge is usually convex; the outer edge or back is thick and heavy. It has not been worked, and must be held in the hand to be used saw or knife fashion. It is submitted that they show themselves to have been cutting implements used after the manner of knives, and not to have been either arrowpoints or spearheads.

The major proposition of this chapter is that many aboriginal implements having the appearance of arrowpoints or spearheads, and heretofore generally so classed, were not such, but were in reality knives intended for cutting or sawing purposes. The specimens on Plate 53 are evidence in favor of this. The lower or butt end of these specimens has a stem, with base, notches, shoulders, barbs, sharp edges, etc., and in all these regards they resemble the ordinary arrowpoint

or spearhead. The point, however, while symmetrically formed and thoroughly worked, is not sharp, but is a well-rounded oval, impossible for thrusting or piercing.

On page 941 of the classification of arrowpoints and spearheads, among peculiar forms, a certain series is shown as Class II, asymmetric. These are there mentioned as being possible knives, and were inserted to complete the classification. No opportunity then offered to investigate their true character or to bring out their peculiarities. Plates 54 and 55 and fig. 195 are here introduced in continuation of that investigation. The original of fig. 195 belongs to the collection of Dr. Roland Steiner. There are 122 specimens of this series which are represented by fig. 195 and certain specimens on Plate 55. They resemble arrowpoints and spearheads, having the same stem, base, shoulders, and barbs. So far as relates to the stem end, their resemblance is perfect, and they might belong to any class of stemmed arrowpoints or spearheads. Some are rather thick and rude, but many are thin and finely chipped. Their peculiarity is their asymmetric form. They are lopsided, or one-sided. The shoulder or barb is on only one edge. The other has been chipped off in the ruder specimens from one side only, making a concave scraping edge, possibly for arrow shafts, while the finer ones are chipped from both sides and are not concave; but in both kinds of specimens the shoulder or barb is on one side only, and that has been brought to a smooth, sharp edge. An examination of these specimens, a number of which are shown in Plates 54 and 55, shows clearly their asymmetric character and makes apparent at a glance their knife-like appearance. A short handle attached with sinew, as in the case of ordinary arrowpoints or spear heads (Plate 45), or with gum or bitumen, as in the California specimens (Plates 41-43), will make a knife suitable for all known savage needs.

Fig. 195.

UNILATERAL KNIFE OF YELLOW FLINT.

Georgia.

Steiner collection. Cat. No. 171159, U.S.N.M.

All differentiation rendering them suitable for knives renders them unsuitable for arrowpoints or spearheads. They are heavier on one side than on the other, which renders them lopsided and would throw them out of the line of flight and destroy their efficacy as projectiles. It is believed that even a slight examination demonstrates the correctness of the conclusion that they were knives, rather than arrowpoints or spearheads.

Concluding the chapter on knives, it is deemed wise to introduce for comparison a series of those which heretofore passed for and have been recognized as knives. The author does not remember any specimens of the asymmetric or unilateral form in Europe, except those from Solutré which do not belong to the Neolithic period. Knives were, however, by no means rare among the prehistoric implements of that

EXPLANATION OF PLATE 54.

UNILATERAL KNIVES.

Fig. 1. YELLOW FLINT.
(Cat. No. 10824, U.S.N.M. Bahala Creek, Copiah County, Mississippi. T. J. R. Keenan.)

Fig. 2. BROWN CHERT.
(Cat. No. 60597, U.S.N.M. Lincoln County (?), Tennessee. C. S. Grisby.)

Fig. 3. CHERT.
(Cat. No. 34863, U.S.N.M. Falmouth Island, in Susquehanna River, Pennsylvania. J. Orendorf and F. G. Gailbraith.)

Fig. 4. DARK-GRAY FLINT.
(Cat. No. 7672, U.S.N.M. Groveport, Ohio. W. R. Limpert.)

Fig. 5. MOTTLED-GRAY FLINT.
(Cat. No. 23265, U.S.N.M. Mound on Etowah River, Georgia. B. W. Gideon.)

1

2

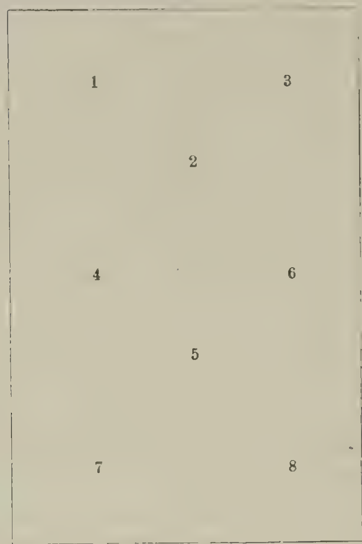
3

4

5

UNILATERAL KNIVES.

EXPLANATION OF PLATE 55.



UNILATERAL KNIVES.

Fig. 1. BROWN JASPER.
(Cat. No. 31583, U.S.N.M. (Locality unknown.) Dr. T. H. Bean.)

Fig. 2. PALE-GRAY FLINT.
(Cat. No. 32753. U.S.N.M. Richmond, Jefferson County, Ohio. Samuel Houston.)

Fig. 3. PINK FLINT.
(Cat. No. 171459, U.S.N.M. Burke County, Georgia. Dr. R. Steiner.)

Fig. 4. GRAY FLINT.
(Cat. No. 62104, U.S.N.M. Mason County, West Virginia. R. W. Mercer.)

Fig 5. FLINT.
(Cat. No. 30179, U.S.N.M. (cast). Illinois. Dr. J. F. Snyder.)

Fig. 6. GRAY FLINT.
(Cat. No. 59221, U.S.N.M. Tennessee. C. L. Stratton.)

Fig. 7. WHITE FLINT.
(Cat. No. 196505, U.S.N.M. Louisiana. Phillips collection.)

Fig. 8. WHITE FLINT.
(Cat. No. 4935, U.S.N.M. Illinois.)

UNILATERAL KNIVES.

FLINT FLAKES CHIPPED ON ONE EDGE ONLY, INTENDED FOR KNIVES.

EXPLANATION OF PLATE 56.

1 2 3 4

FLINT FLAKES CHIPPED ON ONE EDGE ONLY, INTENDED FOR KNIVES.

Fig. 1. FLINT.

(Cat. No. 27001, U.S.N.M. Cumberland Mountains, Tennessee. Gen. J. T. Wilder.)

Fig. 2. FLINT.

(Cat. No. 60265, U.S.N.M. Tennessee. C. S. Grigsby.)

Fig. 3. FLINT.

(Cat. No. 19234, U.S.N.M. Louisville, Kentucky. Dr. James Knapp.)

Fig. 4. FLINT.

(Cat. No. 100257, U.S.N.M. Spiennes, Belgium. Thomas Wilson.)

1

2

3

4

FLINT FLAKES CHIPPED ON ONE EDGE INTENDED FOR KNIVES.

EXPLANATION OF PLATE 57.

1 2

3 4

FLINT FLAKES CHIPPED ON ONE EDGE, INTENDED FOR KNIVES.

Fig. 1. GRAYISH FLINT.
(Cat. No. 29024, U.S.N.M. Milnersville, Guernsey County, Ohio.)

Fig. 2. GRAY JASPERY FLINT.
(Cat. No. 98089, U.S.N.M. Kentucky. W. M. Linney.)

Fig. 3. YELLOW JASPER.
(Cat. No. 7050, U.S.N.M. Union County, Kentucky. S. S. Lyon.)

Fig. 4. PALE-GRAY FLINT.
(Cat. No. 32421, U.S.N.M. Lick Creek, Orange County, Indiana. F. M. Symmes.)

country. One of these knives is represented in Plate 56, fig. 1. It is nothing more than a smooth flake struck from a nucleus of flint in such way as to make or leave a natural edge sharp for use. Specimens similar to this in appearance and manufacture, and supposed to have been made and used as knives, are found in great profusion throughout western Europe, almost every excavation in a prehistoric occupation bringing these flakes to light in greater or less number. The same statement can be made in respect to America. Plate 57, figs. 1, 2, are specimens of similar flint flakes from America, supposed to have been used as knives. Flakes of the same general character, but chipped to a sharp edge, are found in both Europe and America and are also supposed to have been used as knives. Whether they have been dulled by use and the edge then restored by chipping is unknown. It is known, however, that the worked flakes, either primarily or secondarily chipped to an edge, have been found in many of these places and that they are generally accredited as knives. The other specimens on Plates 56 and 57 are representatives of these worked flakes.

The subject of knives is not exhausted. It has not even been considered except as it involves arrowpoints or spearheads.

X. WOUNDS BY ARROWPOINTS OR SPEARHEADS.

The author of the Manuel du Chirurgien d'Armée declared that military surgery had its origin in the treatment of wounds inflicted by arrows and spears, and in proof thereof he quoted from ancient classics [1] and cited Chiron and Machaon's patients, Menelaus and Philoctetes, and Eurypyles treated by Patroclus. He believed the name "medicus" in the Greek anciently signified "sagitta," an arrow,[2] and declared that Hippocrates used a particular forceps, "beluleum," for extracting arrows, which his successor, Diocles, improved and called "graphiscos."[3] Heras of Cappadocia, in the wars of Augustus, invented the duck-bill forceps. Celsus [4] taught the necessity of dilating the wound in order to extract the arrowhead, and Paulus Ægineta [5] treated arrow wounds in a peculiarly successful manner.

The author, Baron Percy, who thus showed his knowledge of classic medical literature, supposed he had discovered the origin of surgery and was dealing with the earliest wounds made by man with the machinery of war.

The discovery in the present century, of prehistoric man, and the repeated findings of his graves and cemeteries belonging to the Neolithic and Bronze ages, and the thousands of skeletons therein, many of them with wounds and fractures—these things have completely over-

[1] Homer, Iliad, Book XI.
[2] Sextus, Advers. Math., Book 1, chap. 2.
[3] Andrea della Croce, Book 7, p. 173, Venice, 1574.
[4] De Medicina, Book VII, chap. V.
[5] De re Medica, Book VI, chap. 88.

turned the ideas of Baron Percy as to the earliest human wounds and the origin of surgery.

In an earlier chapter we have seen how the ages of stone and bronze had practically passed away without any historical mention of their existence. The beginning of history is subsequent to them. Nowhere in the Eastern Hemisphere, nor elsewhere except among modern savages, have stone arrowheads been known in historic times. Arrowpoints may have been used by the million in times of antiquity, but those known to history, noted by historians, were all of iron or bronze; none were of stone. In the army of Xerxes only one tribe, blacks from the interior of Africa, had arrows tipped with stone. All others used iron or bronze. The age of stone arrowpoints or spearheads had passed away before the time of Xerxes. All of which only shows how sadly mistaken was the author of the Manuel du Chirurgien d'Armée in his opinion as to the origin of surgery and the dates of the earliest wounds made by man's weapons.

It has been thought by many persons, among them a number highly qualified to judge, that there were no burials made during the Paleolithic period in western Europe. Whether this be true or not, it must be admitted that, either because of the rarity of the burials or the immensity of time which has elapsed, or possibly the failure to discover the graves, or for these reasons either singly or collectively, there have been comparatively few of the skeletal débris of Paleolithic man found. And this would satisfactorily account for the few examples of wounds found. The skeletons from the cave at Cro-Magnon show evidence of wounds. The femur of the man has been broken, while the forehead of the woman that lay beside him bears a large gash, made apparently with a flint hatchet.

Broca, who examined these specimens, is of the opinion that the latter bore traces of suppuration and evidences of healing.[1]

Dr. Hamy reports many of the bones in the cavern at Sordes as having curious wounds, one a gaping wound in the right parietal of a woman who, like that of Cro Magnon, must have survived the injury for some time. Pieces of bone had been removed and there was evidence of healing.[2]

There has been some question as to whether these caves belonged to the Paleolithic period. It makes but little difference to the present argument, for we will soon see that in the Neolithic period such wounds, made sometimes by hatchets or by blows of other weapons, and sometimes by thrusts received by arrows or spears, were found in considerable number.

Dr. Prunières, of Marvajols (Lozère), France, a surgeon, anatomist, and an early student of prehistoric anthropology, conducted many original excavations into the dolmens, tumuli, and burial places of his

[1] Broca, Les Ossements des Eyzies, Paris, 1868.

[2] Lartet and Chaplain-Duparc, Une Sépulture des Anciens Troglodytes des Pyrénées.

neighborhood, and had the good fortune to make a large collection of objects pertaining to prehistoric man in that country. He took special care to search for and preserve all those relating to physical anthropology, especially those showing skeletal peculiarities. The following is a partial list of objects in his collection relating to arrow wounds:

The superior portion of a tibia, with a deep and suppurated wound, in which is still embedded a flint arrowpoint.

Fragment of the iliac bone, in the internal part of which is embedded an arrowpoint in a wound which showed signs of suppuration.

Another fragment of iliac bone, in the external part of which was embedded an arrowpoint of flint in a suppurated wound.

A dorsal vertebra with flint arrowpoint in a wound in the body of the vertebra—no suppuration.

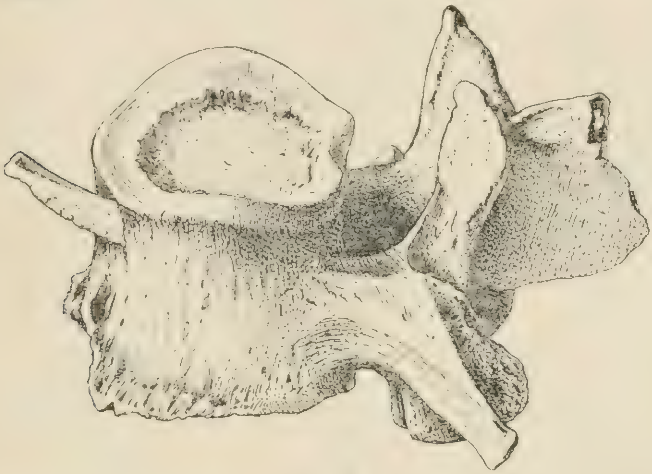


Fig. 196.

HUMAN VERTEBRA (PREHISTORIC) PIERCED WITH FLINT ARROWPOINT (TRANCHANT TRANSVERSAL).

Cartailhac, La France Prehistorique, p. 254, fig. 124.

Lumbar vertebra with a wound which had been much enlarged by suppuration and an arrowpoint embedded it it.

A vertebra with an arrowpoint buried in the body. (Presented before the Congress at La Rochelle.)

A vertebra with an arrowpoint buried in the wound.

An astragalus with arrowpoint in the wound.

The caverns of Baumes-Chaudes and L'Homme Mort were the most complete charnel houses of Neolithic times, each containing about three hundred skeletons capable of identification. It was out of this wealth of material that Dr. Prunières was able to obtain such numbers of peculiar specimens.

The prehistoric anthropologists of France have always realized the importance of examining and preserving the pathologic or traumatic specimens, and so De Mortillet, Cartailhac, Nadaillac, De Baye, and others have reported many specimens bearing evidence of arrow wounds.

Fig. 196 represents a human vertebra pierced by an arrowpoint,

tranchant transversal, from the cavern of Pierre-Michelot (Marne), collected by Baron de Baye. Fig. 197 represents a human tibia with an arrowpoint inserted, found in the dolmen of Font-Rial near Saint-Affrique (Aveyron). Baron de Baye has been, after Dr. Prunières, one of the most successful seekers for these specimens. In the cavern of Villevenard he found one skull containing three tranchant-transversal arrowheads, while another was lodged between the dorsal vertebræ. Other human vertebræ pierced with flint arrowpoints were found in the caves of Petit-Morin. In one sepulchral cavern the Baron found 73 flint arrowpoints, and, as in the case of Villevenard, their position was such as to lead to the supposition that they had been sticking in the flesh of the body at the time of interment and had fallen down as decomposition progressed. A human vertebra was found by M. Cartailhac in the covered ways of Castellet, near Arles, with a stone arrowpoint incrusted therein. The absence of any exostosis shows that death quickly followed. The list of examples or specimens showing arrow wounds might be augmented considerably, but enough instances have been given to show that the use of arrows and other weapons was habitual, and no reason is known why an investigation, if carried to any considerable extent and in any great detail, might not make a large addition to the data already obtained.[1]

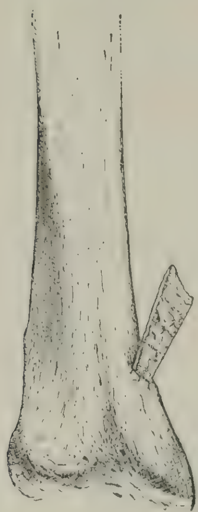


Fig. 197.

HUMAN TIBIA (PREHISTORIC) PIERCED WITH FLINT ARROWPOINT (TRANCHANT TRANSVERSAL).

France.

Fig. 198 (fig. 39—5531, Army Medical Museum) represents an ancient arrow wound in the skull of an aborigine. The skull was originally received by the Smithsonian Institution from Dr. C. Yates, Alameda County, California, and transferred to the Army Medical Museum. It shows a man of advanced age. A long flint arrowpoint had penetrated the skull through the left orbit, and the figure shows it in place as originally found impacted. This specimen is to

Fig. 198.

ANCIENT SKULL PIERCED WITH A FLINT ARROWPOINT, PERFORATOR.

California.

[1] Students desirous of pursuing the subject are referred to Cartailhac's La France Préhistorique, p. 124, figs. 124, 125; L'Anthropologie, VII, 3, 1896, pp. 312, 313, figs. 3, 4; G. de Mortillet, Materiaux, etc., 1877, VIII, p. 161, and others therein mentioned.

ARROWPOINTS OR SPEARHEADS INSERTED IN ANCIENT HUMAN BONES.

Cavern, Kentucky.

Cat. No. (loan) 1062, U.S.N.M.

be remarked as one of a class called perforators or drills and possibly used as such, but here used as an arrowpoint.

Fig. 199 (fig. 37 – 5553, Army Medical Museum) is also a prehistoric specimen. It is from one of the Indian mounds in the vicinity of Fort Wadsworth, Dakota, excavated by Surg. A. T. Comfort, U. S. A., in

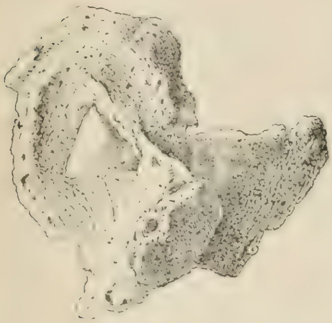


Fig. 199.

ANCIENT HUMAN VERTEBRA PIERCED WITH QUARTZ ARROWPOINT, HEALED.

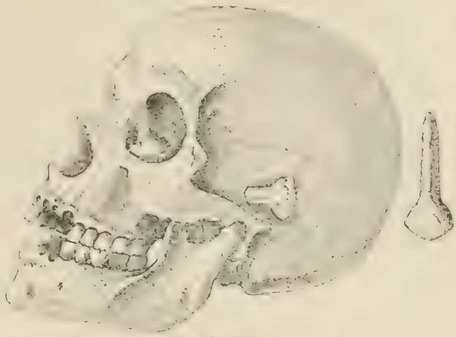


Fig. 200.

ANCIENT SKULL PIERCED WITH PERFORATOR ARROWPOINT.

Illinois.

1869, and consists of a human lumbar vertebra with a small arrowpoint of white quartz incrusted in it. It is covered with a new bony formation, showing that the wounded man survived the injury some months at least.

Fig. 200 (Cat. Nos. 60281, 60282, U.S.N.M.) represents an ancient aboriginal skull from Henderson County, Illinois, forwarded by M. Tandy. It had a hole in the squamosal bone on the left side, in which, when found and received by the Museum, was a stone arrowhead, still another perforator or drill.

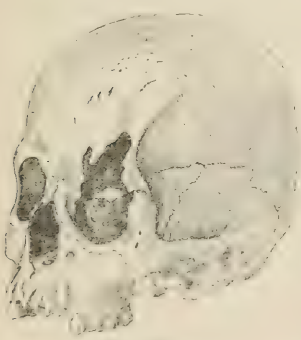


Fig. 201.

ANCIENT SKULL, ARROW WOUND OVER LEFT EYE ENTIRELY HEALED.

Missouri.

Fig. 201 (Cat. No. 173995, U.S.N.M.) represents a human skull from a mound in Missouri. The subject had received a serious wound in the supraorbital arch at the outside of the left eye. The wound involved all the bones of the interior arch, which was broken down. The wound had entirely healed, the cicatrization was complete, and all the wasted or destroyed pieces of bone around the wound had sloughed off and the reparation of the bone been fully effected. Of course the missile with which this wound had been inflicted did not remain in the wound, and it was not found, but from the smallness of the wound and its penetration one can only conclude it was made by an arrowpoint.

Plate 58 represents two prehistoric specimens of flint arrow or spear

heads found inserted in human bones. These specimens were sent to the U. S. National Museum by Dr. John E. Younglove, of Bowling Green, Kentucky. Fig. 1 represents an implement $3\frac{1}{2}$ inches long, $1\frac{3}{8}$ inches wide, and one-fourth of an inch thick. The stem is broken, which shortens it considerably. It had pierced entirely through the human pelvic bone in which it was found. Fig. 2 is 4 inches long, $1\frac{3}{8}$ inches wide, and one-fourth of an inch thick. It is inserted in the head of a human femur(?). Fig. 1 is loose so that it may be taken out of its present socket, while fig. 2 is firmly embedded and can not be removed. The material of both is the black or brown lusterless pyromachic flint con mon to the country in which it was found. The specimens came fro a cavern about 4 miles northeast of Bowling Green, and an equal d. tance from Old Station. The opening at the surface was about 3 fee in diameter and the hole about 40 feet in depth. At its bottom th cave extended horizontally several hundred feet through solid rock. There is no way of telling whether these implements were used a arrows or spears; the shafts which would alone determine that hav entirely disappeared, or at least no fragments of either wood or sinew were reported. If arrows, they must have been used with an enormou bow; it is more likely that they were mounted upon a larger and heavie shaft and used as spears or javelins.

Looking at these heavy projectiles, considering the conditions of th hand to hand fight wherein they were used, and the force with whic they were hurled, it is astonishing that at least one of the fighters, the specimens belong to different individuals, not only survived th shock, but the patient recovered with the weapon embedded in th wound, for its cicatrization is found to be complete.

APPENDIX A.[1]

MINES, QUARRIES, AND WORKSHOPS.

The following memoranda of prehistoric flint mines or quarries and workshops of aboriginal stone implements in the United States have been compiled mostly from reports made by investigators in the field. They are here brought together and published for convenience of the student.

MAINE.

Mount Kineo, on the eastern shore of Moosehead Lake, has furnished material for aboriginal arrowpoints and spearheads for hundreds of miles down the Atlantic coast. It is usually called Mount Kineo flint, but is really a porphyritic felsite or rhyolite.

NEW YORK.

Erie County.—Extensive flint-arrowpoint factories in the vicinity of Buffalo and along the river shore; marked by the presence of flint and piles of chipped pieces. Reported by Dr. A. L. Benedict, Buffalo.

Chautauqua County.—Some years ago, Mr. Williams, plowing a field on his farm, in the town of Sheridan, turned up as much as two bushels of flint spalls or chips and a number of arrowpoints and spearheads. These were together, and led Mr. Williams to suppose that Indians made their tools there. Some of these implements correspond in outline and material to those from Flint Ridge, Ohio. James Sheward.[2]

Montgomery County.—Deposit of flint arrowpoints in the town of Amsterdam. Described by P. M. Van Epps.[3]

NEW JERSEY.

Mercer County.—"Open-Air Workshops" (chips of jasper and flint) in Hamilton Township.[4]

"Open-Air Workshops" are treated at length by Dr. Abbott, and examples are cited; one near Belvidere, New Jersey, and one in Hamilton Township, Mercer County, New Jersey, which was greatly elaborated by excavation and description. The remains of human industry found in the quarries are thus classed by Dr. Abbott: (1) Masses of jasper and altered mineral; (2) cores and remains of no further use; (3) large flakes; (4) blocked-out and discarded specimens; (5) specimens nearly finished and then discarded—these are of the arrowheads with point, stem, or barb broken off; (6) chips and splinters of every size; (7) hammerstones of utilized pebbles, mostly with shallow depressions, one on each side; (8) flat-slab stones of small size and traces of hammering on either side, probably used as lapstones—making in all about a thousand pieces. There was no trace of argillite used as a material.

A second and third find in the same vicinity are described in the same paper (p. 516).

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[1] See p. 871.

[2] Smithsonian Report, 1881, p. 644.

[3] American Antiquarian, 1880, III, p. 57.

[4] C. C. Abbott, Report Peabody Museum, XII, 1880, pp. 508-515.

MARYLAND.

Quarry of rhyolite near Sugar Loaf Mountain. Dr. W. H. Holmes.

DISTRICT OF COLUMBIA.

Ancient quarries near Washington.[1]
Prehistoric quarries in the vicinity of Washington.[2]
Ancient village sites and aboriginal workshops.[3]
Contributions to the Archæology of the District of Columbia.[4]
A quarry of quartzite bowlders has been discovered on the hills at Piney Branch, together with an extensive manufactory of rude implements. It was excavated by Dr. W. H. Holmes and is described at length.[5]

WEST VIRGINIA.

Putnam County.—Ancient furnace, 4 miles east of Hurricane, on the farm of J. J. Estes. Described by Mr. P. W. Norris.

NORTH CAROLINA.

Cherokee County.—Ancient mining excavations on farm of Mercer Fain, near Colvard Creek, on north side of Valley River, 5 miles above Murphy. Other old mining indications in the same county. Reported by James Mooney.

GEORGIA.

Savannah River.—At some points, even in the depths of the swamp region, may still be noted traces of small open-air workshops. * * *

These exist not only along the line of the Savannah River, but frequently occur on the banks of the Oconee, Ocmulgee, the Flint, the Chattahoochee, and other Southern streams. * * * Within the past few years not less than 8,000 well-formed arrow and spearpoints have been collected on both banks of the Savannah where it separates the counties of Columbia and Lincoln in Georgia and Edgefield County in South Carolina. Even now the supply is by no means exhausted. The annual plowings and constantly recurring freshets reveal each season new examples of the taste and skill of these ancient workmen. In the enumeration of the implements taken from this locality we do not include multitudes partially formed and broken, which, with quantities of chips, still mark the spots set apart for the manufacture. Sometimes we encounter a locality, many yards long and several wide, the surface of which is covered to the depth of several inches with fragments struck off during the process of manufacture, and with cores and wasters abandoned from some inherent defect in the material or broken by the workman. Some idea may thus be formed of the extent and duration of the labors of these primitive workers in stone.[6]

Jefferson and Burke counties.—Dr. Roland Steiner, now of Grovetown, Georgia, has been, during almost his entire life, an enthusiastic collector, and has pushed his investigations in many directions throughout the State. He formerly lived near

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[1] Elmer R. Reynolds and F. W. Putnam, Report Peabody Museum, XII, pp. 475, 526–535.

[2] T. R. Peale, Smithsonian Report, 1872, pp. 430–432.

[3] S. V. Proudfit, American Anthropologist, II, pp. 241–246.

[4] Louis A. Kengla, 1883.

[5] American Anthropologist, January, 1890, III, p. 1; Fifteenth Annual Report Bureau of Ethnology, 1893–94, pp. 33–66; and American Naturalist, XXX, December, 1896, pp. 874–885; No. 360, December, 1896, pp. 976–992.

[6] Charles C. Jones, jr., Smithsonian Report, 1879, pp. 378, 379.

Waynesboro, in Burke County, and from that neighborhood he obtained many implements and made many important discoveries. He reports that there are outcrops of jasper on Rocky Creek, at the crossing of the Waynesboro road. Other quarries were found in the neighborhood; one of white flint at Erin, and one of yellow flint at Oldtown, 10 or 12 miles west in Jefferson County. There were workshops on what he calls the Davis plantation or the Old Evans place, at the crossing of Little Buckhead Creek by the Waynesboro road; one of these was 2 miles up the stream at Captain Ridgely's. Dr. Steiner exhausted this neighborhood in his search. He found on the Old Evans place, in the valley of the Little Buckhead, within an area of 40 acres, no less than 16,000 prehistoric implements, most of which were of the same material as the neighboring quarries and had probably come from them, but many of them were of different material and had come from different and perhaps distant quarries.[1]

There is in the U. S. National Museum a collection of arrow and spearheads called, after its finder, the McGlashan collection, from Georgia. It comprises about 20,000 specimens. They are of divers forms and sizes, are all of cherty flint, and apparently from one quarry. They are much weathered and their color ranges from yellow and rose to white. Plate 38, figs. 20–23 are photographs of specimens from the collection and show the appearance of the material.

FLORIDA.

Hernando County.—Arrowpoint factory on the banks of Trouble Creek, 2 miles north of the mouth of the Anclote River, and 5 miles south of Kootie River.

"About 5 miles south of the Kootie River, and some 2 miles north of the mouth of Anclote River, is a small stream called Trouble Creek. A considerable body of blue flint rock occurs here, cropping out along the shores of the creek, with scattering nodules lying in all directions. This point was evidently used for a long time by the aborigines as a factory for arrow and spear heads. Bushels of chips and fragments strew the ground, and large quantities have been washed from the banks of the creek and cover its bottom. A long search revealed nothing except a few arrowpoints and spearheads spoiled in making, and a lot of broken pottery."[2]

ALABAMA.

Lee, Jefferson, Lowndes, and Talladega counties.—Mica mine and stone wall in Clay Township, Jefferson County, Alabama. In Talladega County, township 20 north, range 6 east, section 12, another mica pit. "Workshop" in Lee County, Alabama, east of Youngsboro, on the Western Railroad, at the foot of Story's Mountain in the fields, township 19 north, range 27 east. William Gesner.[3]

Several "workshops" are near Mount Willing, one on Mr. Hartley's plantation, section 36, township 18 north, range 13 east, and one on Mr. Lee's plantation, section 32, township 13 north, range 14 east. Described by William Garrett.[3]

"Workshops" in township 18 north, range 7 east, of Talladega County, on the headwaters of Talladega Creek, at the eastern end of Cedar Ridge, a spur of the Rebecca Mountain (Potsdam sandstone), in the old fields where the Montgomery Mining and Manufacturing Company's works were situated; wagonloads of quartz fragments, broken arrowpoints, and spearheads cover the ground; but on a much larger scale appears to have been the manufacture of these implements in township 19 north, range 27 east, of Lee County, on the Columbus, Georgia, branch of the Western Rail-

[1] R. Steiner, private letters.

[2] T. S. Walker, Smithsonian Report, 1879, p. 394.

[3] W. M. Garrett, Smithsonian Report, 1879, p. 443.

road, east of Youngsboro, for in the fields on the southeastern side of a low ridge called Story's Mountain, acres are covered with the broken quartz in every variety of that mineral found in this hill, from transparent rock crystal to jasper and chalcedony, among which occasional good implements occur.[1]

OHIO.

Licking and Muskingum counties.—Throughout eastern Ohio there are numerous deposits of flint of various descriptions, and in several counties places are to be found in which the "ancient arrow maker" practiced his calling with the material so abundantly supplied.[2]

Flint quarry on Williams Hill, Licking County, 3 miles west of Brownsville. Reported by Gerard Fowke.

Chandlersville, Salt Creek, Muskingum County, Ohio, was the scene of the operations of the Muskingum Mining Company in 1820 for mining silver. It was on the National road, 10 miles east of Zanesville. A writer, evidently well-known, though his name is not given, tells[3] of a trip he took through this country, and describes the wells and pits sunk here by the company in which he was a subscriber, part owner, and heavy loser. He says, in his report of excavations and drillings, that at a depth of 120 feet they struck a bed of gray flint rock, 6 or 8 feet in thickness. He continues the record of his journey:

"One mile east of Somerset the National road commences crossing at Flint Ridge. [Plates 13–15.] Its general course is from northeast to southwest, passing through the counties of Coshocton, Licking, Muskingum, Perry, Hocking, and Jackson, and probably into Kentucky. In Hocking County it seems to have been deposited in a fine siliceous paste of various colors, from pure white to yellow, clouded, and black, and is used for whetstones. In Jackson and Muskingum counties it is extensively manufactured into buhr millstones. The whole deposit abounds in casts of fossil shells beautifully replaced in many cases by pure quartz. Some are studded over with drusy crystals, others filled with chalcedony and quite translucent. The various families of Producti, Ammonites, Nautili, Encrine, etc., with many undescribed species, are found here. * * * In many places it abounds in jasper, hornstone, flint, quartz, chalcedony, etc., of various and intermingled colors" (p. 233).

Washington County.—A "magazine" of arrowpoints and spearheads at Waterford, near the banks of the Muskingum.[4]

Perry County.—Flint diggings at New Lexington.

"At New Lexington, Perry County, Ohio, on a knoll near the railroad station, are many ancient flint diggings. The flint here constitutes a regular layer or stratum in the coal measures and is about 4 feet thick. It is well exposed in the railroad cut on the side of the knoll. Geologically speaking, the flint is a local modification of the Putnam Hill limestone, a well-defined stratum of wide extent in southeastern Ohio. Many of the pits must have been from 6 to 8 feet deep. The flint is fossiliferous, and much of it is not compact enough for arrowheads, and around the old excavations are heaps of the rejected material. These excavations are now largely refilled with earth and débris. I had no time to reopen any of them in search of the tools by which the flint was quarried. I have little doubt that these pits were sunk by the mound builders."[5]

Mahoning County.—Flint diggings in the southwestern corner of the county. Reported by Mr. Gerard Fowke.

Coshocton County.—Deposits of chalcedony, basanite, etc., on land of Col. Pren. Metham, Mr. R. R. Whittaker, and Mr. Criss, in the south-central portion of Jefferson Township. Reported by Mr. Gerard Fowke.

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[1] William Gesner, Smithsonian Report, 1881, p. 617.
[2] Charles M. Smith, Smithsonian Report, 1884, p. 853.
[3] American Journal of Science and Arts, XXV, p. 226.
[4] Haywood, Natural and Aboriginal History of Tennessee, p. 35?.
[5] E. B. Andrews, Report Peabody Museum, X, pp. 53, 54.

INDIANA.

Crawford County.—Mr. H. C. Hovey gives an account of a flint mine and workshop in Wyandotte Cave.[1] He says that there are what had been called "bear wallows" not far from the Pillard Palace. "These are circular depressions, twenty or more in number, each a yard wide and a foot deep, and their appearance agrees well with their name. About two years ago, however, I had the satisfaction of proving them to be the remains of ancient flint works. Happening to remove the clay crust from a bear wallow, I found a pile of ashes and cinders on one side and a quantity of flint chips on the other. On examination this proved true of each wallow. Further removal of the crust brought to light hundreds of flinty prisms with parallel faces and averaging 4 inches in length by 1½ in width and half an inch in thickness.

"The mine is near by, abounding in flint nodules lying in rows in the cave walls, and occasionally in bands or belts. Each nodule has a coating of some grayish mineral, perhaps discolored flint, and between them is usually a soft, chalky substance, easily cut by a knife. Freshly fractured, a bright black surface appears, in contrast with the dingy, faded blocks by the wallows. This change of hue is due to the gradual removal of the traces of iron found with the silex. Many of the blocks were rejected on account of flaws or imperfections. The nodules are easily split into this form, which is convenient for transportation. Arrow making, however, was carried on here to a considerable extent, as appears from the chips. Pounders like those in the alabaster quarries were found along with the flints, showing the means of breaking the nodules.

"The only manufactured article dug up in this spot was a little stone saucer containing a soft, black substance. This may have been a rude lamp.

"Search at the mouth of the cave unearthed quantities of flint chips, and also finished arrowheads. The question has been raised why the Indians should delve for flint balls amid subterranean darkness when quantities of such spheres are found along the beds of streams and elsewhere in the open air. The reason is that the latter, having been exposed to the elements, have deteriorated in quality; they also break with irregular cleavage. Hence the Indians sought to get flints fresh from the strata where they were originally deposited, and which, because of their moisture, readily part into triangular prisms under the hammer.

"Since finding the existence of this flint mine in Wyandotte Cave, I have learned of the flint pits dug along Indian Creek and elsewhere in Harrison County, Indiana."

Franklin County.—Workshops have been discovered on sections 3, 4, and 20, township 9 north, range 2 west; section 10, township 12 north, range 13 east.[2]

Union County.—Workshops on sections 12 and 17, township 10 north, range 2 west; sections 4 and 9, township 11 north, range 2 west; sections 21 and 29, township 12 north, range 2 west; and sections 27 and 36, township 13 north, range 13 east.[3]

Fayette County.—Workshop N. W. ¼ of S. W. ¼ section 36, and S. W. ¼ of S. E. ¼ section 27 township 13 north, range 13 east.[4]

ILLINOIS.

Union County.—"Three miles west of Cobden, near Kaolin Station, on the St. Louis and Cairo Railroad, is the most extensive workshop I have found. It covers several acres of ground, and carloads of flint chips and bowlders are strewn everywhere. Four miles south of Cobden is another of smaller dimensions. Others of greater or less size are met with in various parts of the county, but no relics of much value are found with them."[5]

[1] Proceedings, American Association for the Advancement of Science, XXIX, 1880, p. 730. Boston.

[2] George W. Homsher, Smithsonian Report, 1882, pp. 730–749.

[3] Idem., pp. 728–749.

[4] Idem., pp. 737–749.

[5] F. M. Farrell, Smithsonian Report, 1881, pp. 584–586.

Extensive flint quarry near the town of Mill Creek. This quarry is of the white chert peculiar to Illinois, and furnished the large oval chipped implements supposed to have been used as digging tools or for agricultural purposes. The quarry was discovered in May, 1899, by Dr. W. A. Phillips and Edward F. Wyman, and opened by Drs. Phillips and Dorsey, of the Field Columbian Museum.[1]

TENNESSEE.

Cooke County.—Workshop on the ridge. Quantities of flint chips, etc., scattered over the ground. Reported by J. W. Emmert.

KENTUCKY.

Ohio County.—A flint implement factory on Wade N. Martin's farm, Cromwell post-office. Reported by Mr. J. M. Brown.

Wyandotte County.—There are a number of mounds near Wyandotte, Kentucky, of which a map is in preparation. A workshop 1 acre in extent and covered with chips and shreds is reported.

"About two years ago I discovered on the farm of J. L. Stockton, 1 mile northwest of this city, remains of an aboriginal workshop or village. It is located on a small stream called Jersey Creek, and near a large spring. It covers an area of about 2 acres. The soil is sandy, and to the depth of 2 feet is a complete mixture of flakes of flint, ashes, bones—both animal and human—fragments of ornamented pottery, broken and unfinished stone implements of nearly every description. * * * There are no deposits of flint or other stone valuable for arrow making, etc., in this vicinity. The axes, celts, skin dressers, and balls are all made of porphyry, and the arrowheads of flint."[2]

TEXAS.

Goliad County.—Flint workshop on the margin of Lone Tree Lake, 2 miles west of San Antonio River, and 7 miles south of the town of Goliad. The lake margin was of sand, covering, to a depth of 4 or 5 feet, the flint workers' site. This was about 150 yards long by 50 wide, the débris, chips, flakes, arrowpoints, spearheads, and tools, being on and in the clay under the sand, and estimated at 10 bushels in sight.[3]

ARKANSAS.

Garland County.—Quarries of novaculite were found in Garland County, Arkansas.[4] Dr. Holmes reports everywhere the aborigines found and worked these transported masses (from the quarry), and hundreds of square miles are strewn with flakes, fragments, failures, and rejected pieces, and the country around, from the mountains to the Gulf, is dotted with the finished forms that have been used and lost.

Hot Springs County.—Ancient novaculite mines near Magnet Cove.[5]

Novaculite is one of the varieties of flint and, where obtainable by prehistoric man, was much used for the larger and ruder kinds of implements.

The subject of novaculite quarries is treated by Mr. L. S. Griswold, under the title of "Whetstones and Novaculites of America."[6]

The Quarterly Geological Journal[7] contains the report of an investi-

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[1] George A. Dorsey, Report of Field Columbian Museuem, June, 1899.

[2] E. F. Serviss, Smithsonian Reports, 1879, p. 433; 1881, p. 528.

[3] J. D. Mitchell, Victoria, Texas, letter of June 24, 1894.

[4] W. H. Holmes, American Anthropologist, October, 1891, p. 313.

[5] W. P. Jenney, American Anthropologist, October, 1891, p. 316.

[6] Annual Report of the Geological Survey of Arkansas, 1890.

[7] London, Vol. L, Pt. 3, No. 199.

gation by Mr. Frank Rutley on "The origin of certain novaculites and quartzites."

Clark County.—Aboriginal workshop in section 17, township 5 south, range 23 west, from which arrowpoints and cutting implements, the latter hatchet-shaped and made of a species of iron ore, have been taken.

"On section 9, township 3 south, range 24 west, is an outcrop of novaculite or flint of tough quality and of various colors. From this material large quantities of arrowheads, etc., have been made. The ancient artisans went down on the south side of the outcrop, which is a ledge 700 or 800 feet above the adjacent valley, and carried away immense quantities. The material is the same as that of arrowheads from Tennessee, Mississippi, and westward.

"There is on Capt. R. S. Burk's farm, section 17, township 5 south, range 23 west, evidence of an extensive workshop in arrowpoints and cutting implements. The arrow material was taken from the quarry above described, although 10 miles away. The cutting instruments were of the hatchet kind and made from a species of iron ore. There is another workshop near my home, section 7, township 4 south, range 24 west, Montgomery County, Arkansas."[1]

WISCONSIN.

Kenosha County.—Lapham[2] says: "At the city of Kenosha we found, on the ancient sandy beach upon which the city is partly built, abundant evidence of a former manufactory of arrowpoints and other articles of flint. Several entire specimens were collected in a little search, besides numerous fragments that appear to have been spoiled in chipping them into form. * * * Many different kinds of flint, or chert, were wrought at the place, as shown by the fragments. It is probable that the pebles and bowlders along the lake shore furnished the material. * * * These pebbles are the corniferous rock of Eaton and here constitute a portion of the drift, being associated with the tough blue clay that underlies the sand and is the basis of the country around. The clay is carried away by the dashing waves, leaving a beach of clean pebbles. Numerous fragments of pottery of the usual form and composition were also found in the same sandy places."

INDIAN TERRITORY.

An extensive novaculite quarry was discovered and reported to the U. S. Geological Survey by Mr. Walter P. Jenney, which he says was known as the "Old Spanish mines." This report, made in 1891, resulted in the visit of Dr. W. H. Holmes to the locality for the purpose of investigation and study. "The quarry is situated on the Peoria Reservation, about 7 miles northwest of Seneca, Missouri, and some 10 miles southeast of Bâxter Springs, Kansas. From Seneca the spot is reached by driving northward along the Missouri border for 5 miles and then crossing the line and proceeding 2 miles in a westerly course through the forest. The country is a gently rolling plateau, with a gradual descent westward into the valley of Spring River, a branch of the Neosho or Grand River, which falls into the Arkansas at Fort Gibson, Indian Territory."

Dr. Holmes's investigations were published in a bulletin of the Bureau of Ethnology, entitled "An ancient quarry in Indian Territory," 1894. Dr. George A. Dorsey visited this quarry in 1899.[3]

WYOMING.

Central-eastern Wyoming.—Quartzite quarry in central-eastern Wyoming, 40 or 50 miles east of Badger, on the Cheyenne and Northern Railroad, 125 miles north of Cheyenne. Nineteen ancient diggings were cleaned out and the whole quarry inves-

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[1] A. Jones, Smithsonian Report, 1881, p. 542.

[2] Antiquities of Wisconsin, p. 6.

[3] Report, Field Columbian Museum, June, 1899.

tigated. The work was various, superficial, and of great extent. Quarries, shallow, 2 and 3 feet deep, others 15 to 20 feet deep; tunnels and shafts not very deep. Spearpoints, scrapers, axes, and anvils were found; quarry tools, hammers, and mauls were made of bowlders of granite and quartzite, "brought from the neighboring mountains, some 20 miles away." The quarry ground was strewn with chips and fragments of quartzite, but not in heaps as where implements have been made. "The striking points are the vast amount of work done, the absence of chip heaps, the rude nature of the implements, and their great size. The tonnage of rock moved is estimated by hundreds of thousands, if not by millions of tons. * * * Implements made from quartzite resembling that quarried are common on the plains and in the mountains. * * * The quarrymen must have been aborigines, but unlike the Indians of modern times they must have been laborers and to have worked centuries in order to have accomplished so much with the crude tools used. Who they were will never be known. * * * Central-eastern Wyoming is noted for prehistoric quarries, but as a rule they are small and shallow and in no way comparable to the recent discovery. Usually the Indians worked for jasper and agate, and dug irregular openings that do not represent the present systematic development. Quartzite quarries are extremely rare and these are by far the largest reported in Wyoming."[1]

Raw Hide Range.—Dr. A. J. Woodcock reports his visit, in company with and under the guidance of Mr. W. F. Hamilton, of Douglass, Wyoming, to certain flint (?) mines and aboriginal workshops on the Raw Hide Range, southwest from the Black Hills and near Muddy Creek, a branch of the Platte River. About 4 acres had been dug over, and rude pits made from 6 to 12 feet deep, in excavating the desired flinty rock, which lay at that distance below the surface. The stone gave a metallic ring when struck, and broke with a conchoidal fracture. It had "a wealth of color, the basic tints of which were pink, purple, gray, and white, with their intermediate shades, * * * in the shape of chipped tools and weapons * * * so scattered for hundreds of miles throughout the west, * * * through the Powder River country, the Black Hills, the Bad Lands of South Dakota, the Big Horn Mountains, and the great basin of the same name." Mr. Hamilton said he had never seen this material in the ledge elsewhere than in this locality.

The different forms ranged from the quarry spall to "a barbed harpoon head of chipped and polished stone." They picked up a stone hammer weighing 5¼ pounds. The disks were plenteous, some of them 20 inches in circumference and 2 inches in thickness, chipped to a cutting edge. "A thousand trainloads of chips and spalls were beneath our feet on this one butte alone, and Mr. Hamilton said that several others had been worked."

COLORADO.

Jefferson and Clear Creek counties.—"In a small grove of cottonwood trees near Apex, Colorado, the Indians appear to have made, in former times, great quantities of tools and arrowheads, for the ground all around is strewn with tools, chippings, and arrowpoints, some of the latter made of beautiful stone and of the most exquisite workmanship. Within the space of an acre or two we have found about a hundred arrowpoints and ten axes and hammers. The Indians seem to have carried on quite a trade among themselves, in order to procure the materials for arrowpoint-making, as some of the chippings found in their encampments are from stones which can not be found within several miles of this place, and some, I think, have been brought from distant localities. Although the Indians used several kinds of stone in the manufacture of arrowpoints, yet they seem to have had a preference for quartzite, chalcedony, and jasperized wood, probably on account of their superior hardness, and may have made others from handsomer but less durable stones only for purposes of barter, as the Indians of California exchanged arrowheads made of bottle glass.

[1] Wilbur C. Knight, Science, new ser., VII, March 4, 1898.

The following minerals were employed in the manufacture of tools: Moss agate, chalcedony, carnelian, wood opal, sapphirine, petrified wood, flint, red jasper, brown quartzite, agatized wood, obsidian yellow quartzite, purple and yellow jaspers, smoky quartz, chert, jasperized wood, red quartzite, besides several undetermined silicates."[1]

NOVA SCOTIA.

Lunenburg County.—A workshop was reported[2] at Bockmans Beach, Lunenburg County. Large quantities of flakes and splinters of stone, and arrowheads in various stages of preparation.

[1] George L. Cannon, Smithsonian Report, 1877, p. 237.
[2] George Patterson, Smithsonian Report, 1881, p. 675.

APPENDIX B.[1]

CACHES.

In caching or secreting his implements, prehistoric man followed no uniform method of placement, but the deposits are shown to have been intentional. The implements were laid in a circle or rectangle and were placed flat, on edge, or sometimes on end. Leaf-shaped implements have been frequently found en cache, and have been called by some "cache implements," but arrowpoints and spearheads, grooved axes, polished stone hatchets, large chipped flints, spades, and other implements have also been found en cache. It will be seen at once that the term "cache implements" can not with propriety be applied to any particular one.

Reports of caches have been made by their discoverers, and these have been here brought together and published for the convenience of the student.

NEW HAMPSHIRE.

Manchester.—Cache of 40 chipped implements.[2]

MASSACHUSETTS.

Framingham.—"A peck of chipped implements," cached.[3]

CONNECTICUT.

Stratford, Fairfield County.—Cache, number not given. Robert Curtis, in Cyrus Thomas's Catalogue of Prehistoric Works east of the Rocky Mountains.

East Windsor Hill, Hartford County.—Cache of 14 specimens.

South Windsor, Hartford County.—Cache of 100 specimens.[4]

NEW YORK.

Dutchess County.—A cache of arrowpoints was found upon the farm of Mr. George Allerton, at Green Haven, 12 miles from Fishkill on the Hudson. While employed in digging, his spade brought up a number of arrowpoints. He described them to be nicely piled up side by side edgewise, in two or three rows, 10 to 15 inches below the surface. There were perhaps 200 or 300 in all. They are of a blue jaspery flint, and seem to be in an unfinished condition.[5]

Sheridan, Chautauqua County.—Cache of 2 bushels of specimens on farm of Mr. Williams.[6]

Allegany County.—Mr. E. M. Wilson, of Belfast, Allegany County, New York,

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[1] See p. 871.

[2] E. P. Richardson, Smithsonian Report, 1879, p. 447.

[3] J. H. Temple, Smithsonian Report, 1879, p. 448.

[4] E. W. Ellsworth, Smithsonian Reports, 1881, pp. 661, 662; 1879, p. 447.

[5] Edwin M. Shepard, Smithsonian Report, 1877, pp. 306, 307.

[6] James Sheward, Smithsonian Report, 1881, p. 644.

reports that at the old "Iroquois fort," in the town of Angelica, Allegany County, about 1½ miles north of the New York Lake Erie and Western Railroad station of Belvidere were found "many arrow and probably spear heads, unearthed from a small hole near the surface of the ground some distance south or southwest of the inclosure. This was done a few years ago." Also, "there was another and probably similar work [fort] 2 or 3 miles south of the Belvidere 'fort' and on the outskirts of the village of Belmont. * * * A large number of stone implements were found in a hole or cache near by, several years ago."

Broome County.—A cache of arrowpoints, knives, and axes, some in perfect condition but others broken, found near Binghamton.[1]

Montgomery County.—Mr. Percy M. Van Epps, of Glenville, New York, reports[2] a cache of 117 arrowpoints on the farm of Mr. Thomas Romeyn, in the town of Amsterdam, near a spring. They lay about 6 inches below the surface, on a bed of ashes 3 inches thick, which rested on a hearth or fireplace, about 10 feet square, of cobblestones from the drift. The arrowpoints average about 3 inches in length and are of dark-blue and gray flint, leaf-shaped. Mr. Van Epps adds: "Such hoards of arrowpoints are frequent in this vicinity. I know of four instances in a radius of as many miles."

Cache of 120 triangular implements (Division II), straight base, concave edges, of black flint, from Amsterdam, Montgomery County, found by Mr. Percy Van Epps. (Cat. No. 169624, U.S.N.M.)

Saratoga County.—Cache of 90 leaf-shaped implements (Division I, Class B) of hornstone, from Saratoga County, New York, found by H. B. McWilliamson (Cat. Nos. 170333, 170573, U.S.N.M.), represented by 16 and 62 implements, respectively.

Oswego County.—On the line dividing the towns of Volney and Schroeppel was an earthwork on a hill. A long wall, separating the hill from a marsh on the east, still remains. Arrowpoints of flint, en cache, have been plowed up.[3]

NEW JERSEY.

Burlington County.—Cache of 300 triangular arrowpoints (Division II), straight base, convex edges, of gray flint. Found on the south bank of Rancocas Creek, near Lumberton, Burlington County, New Jersey, by W. H. Chambers. (Cat. No. 98740, U.S.N.M.) Average size, 3⅝ by 1¼ by $\frac{3}{16}$ inches.

Mercer County.—In 1861 a farmer near Trenton, New Jersey, while plowing, discovered a cache of stone implements about 15 inches below the surface. Dr. Abbott was notified and repaired to the place, secured the collection, and made a full description of the deposit.[4] The collection numbered about 150 specimens. They were of jasper, finely chipped, leaf-shaped, with a square base (Division I, Class B), and varied in size from 5½ to 7 inches in length, 2½ to 3 inches in width. Two-thirds of the number were arranged in a series of concentric circles, each circle fitting within the other, and they stood upright on their bases. The other third lay flat on their sides and were so placed as to form a wall on the outside.

Trenton.—Mr. Ernest Volk excavated an extensive village site in the neighborhood of Trenton, between that and Dr. Abbott's house and between the road and the bluff. Mr. Volk cites as evidence against the theory of rejects that he found in a single cache, 2½ feet below the surface, where it had evidently been placed for safety, a pile of 15 pieces of chipped argillite, but one of which could have been a completed implement. It was somewhat leaf-shaped. All the rest would have passed, according to the theory, for rejects, but were really selected and secreted, intended, doubtless, to be used at a future time for making implements.

[1] Frank M. Edwards, American Archæologist, August, 1898, p. 221.
[2] American Antiquarian, III, p. 57.
[3] W. M. Beauchamp, Smithsonian Report, 1881, p. 649.
[4] Academy of Natural Sciences, Philadelphia, October 27, 1863, p. 278.

PENNSYLVANIA.

Chester County.—Edward T. Ingram, of Marshallton, discovered a cache of 95 leaf-shaped implements (Division I, Class B), square at the base, 5½ to 7 inches long, 2½ to 3 inches wide, and about three-eighths of an inch thick. They are the counterpart of figs. 102 and 103, and also of No. 3 on Plate 29, Class B, the Abbott specimens heretofore described, in this classification. Mr. Ingram made a division of the implements and sent 61 of them to the U. S. National Museum, where the author has set them up in the form of a cache, as they were found. It is represented in section, as though it had been cut in the center perpendicularly from top to bottom and one-half the earth taken out, leaving the implements projecting as in their original location. The cast is of plaster, reproducing the earth. The original implements are used to represent the exposed half of the cache, leaving the imagination to supply the rest, which are supposed to be within the bank of earth and not to be seen. They were laid flat on their sides, their points to the center, overlapping each other where they came in contact. The entire cache is about 15 or 16 inches in width—a little more than twice the length of the implements. They were laid in a circle, nine or ten of them. This made nine or ten layers and was equal to a height of 14 inches. The top layer was about the depth of a furrow beneath the surface. All former plowing had escaped them, but on the present occasion a deeper furrow had turned them up, and so they were discovered. Plate 59 represents the plan of the cache and shows one layer of the implements.

Cache of 14 or more leaf-shaped (Division I, Class B) argillite implements, found near Brandywine Creek, in Chester County, about 2 miles from West Chester, Pennsylvania. A. Sharpless. (Cat. No. 62374, U.S.N.M.)

DISTRICT OF COLUMBIA.

Cache of 7 stemmed, shouldered, but not barbed (Division III, Class B), implements of quartzite. Found in a bank 2 feet below the surface opposite the navy-yard, District of Columbia. (W. Hallett Phillips collection, Cat. No. 195926, U.S.N.M.)

MARYLAND.

Howard County.—Fifty-two specimens.

Anne Arundel County.—Five caches containing, respectively, 26, 25, 27, 11, and 4 specimens. The foregoing caches are reported by Mr. J. D. McGuire, of Ellicott City, Maryland, and the implements are in his collection.

WEST VIRGINIA.

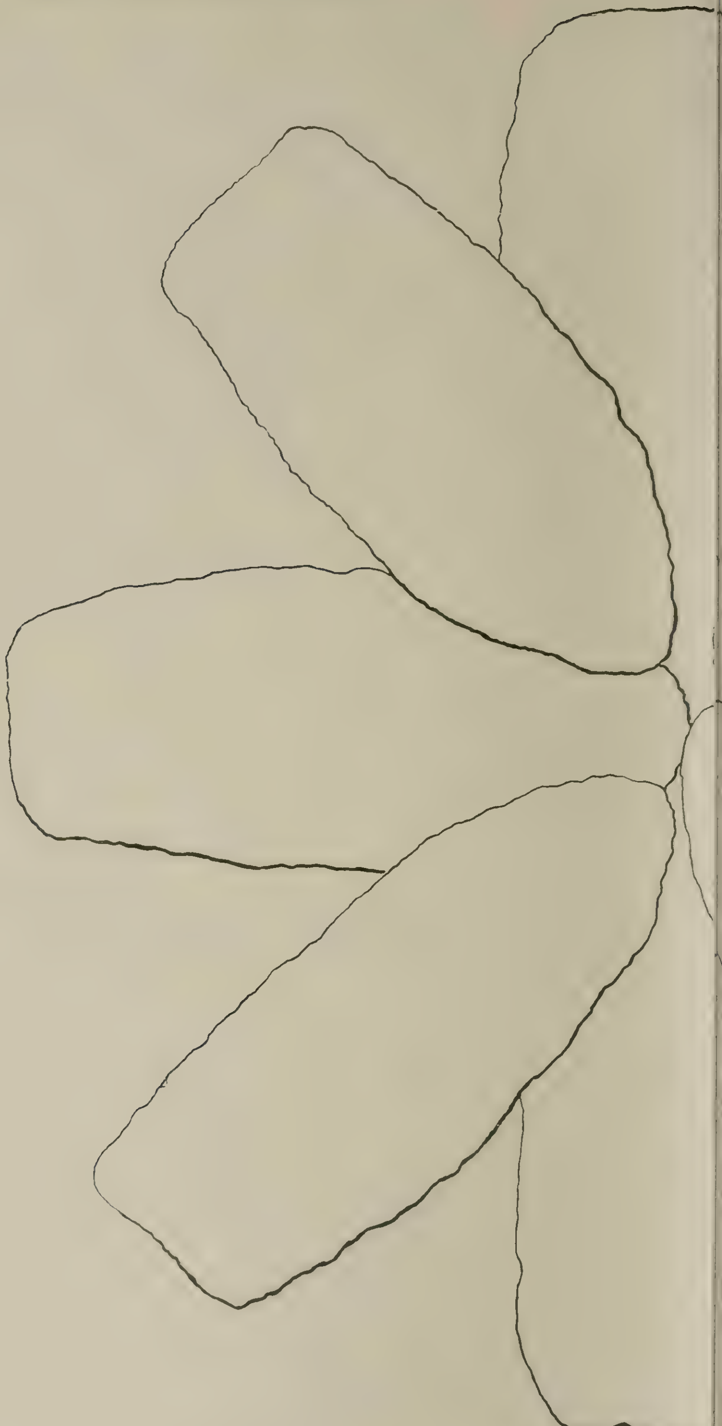
A cache of 400 leaf-shaped implements (Class B) is reported by Dr. J. F. Snyder, of Virginia, Cass County, Illinois, as having been found in West Virginia, locality not given.[1]

NORTH CAROLINA.

Caldwell and Alexander County line.—Dr. J. M. Spainhour, of Lenoir, North Carolina, found a cache of 597 leaf-shaped arrowpoints near the Caldwell and Alexander County line, North Carolina, 16 miles east of Lenoir, in a circular hole in the ground 9 inches in diameter, 25 inches deep. They occupied 13 inches of the excavation, which was filled with earth to the surface. These implements vary in length from 2¼ to 4 inches, in width from 1¼ to 1½ inches, and are ¼ to ⅜ inch thick. The material is porphyritic felsite (called rhyolite when it shows the flow structure), used so much by the aborigines from Maine to Georgia. (Cat. No. 149662, U.S.N.M.)

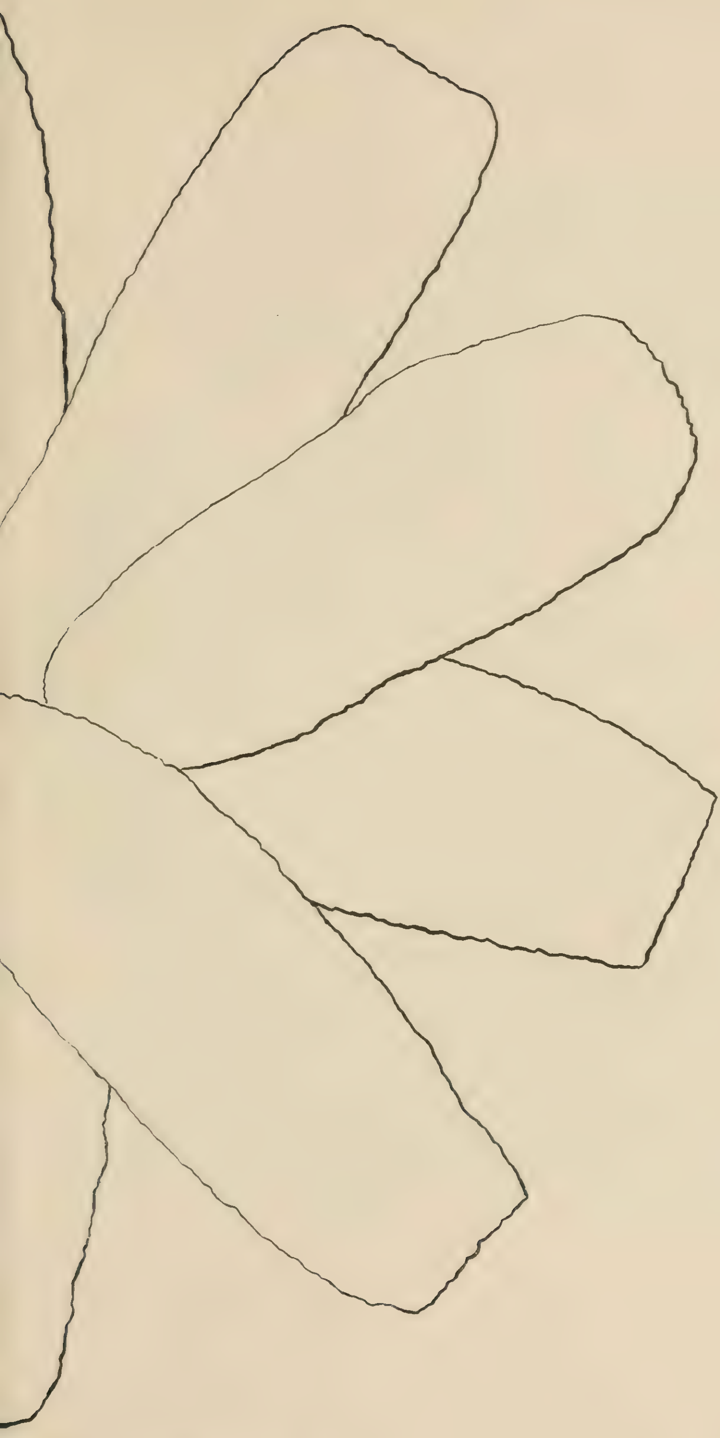
Fifteen leaf-shaped (Division I, Class B) rhyolite implements, found en cache surrounding a spring, as represented in Plate 60, at the head of a rivulet near the foot

[1] Smithsonian Report, 1881, p. 565.



PLAN SHOWING ONE OF LAYER OF CA[illegible]

Chester Cou[illegible]



E OF NINETY-FIVE ARGILLITE IMPLEMENTS.

r, Pennsylvania.

of Hibriten Mountain, 2 miles east of Lenoir, were also found by Dr. Spainhour; $5\frac{1}{2}$ by $2\frac{3}{4}$ inches by $\frac{1}{2}$ inch.[1]

Alexander County.—Cache of 96 small leaf-shaped (Division I, Class B) rhyolite implements. Average size 2 by $1\frac{1}{8}$ by $\frac{1}{4}$ inches. J. D. Stephenson (Cat. No. 61950, U.S.N.M.). "This deposit [cache] was found buried in the soil against a large rock near the Catawba River in the southeastern section of Alexander County. I know of no locality nearer than 70 miles from which the material of which they are made can be obtained."

SOUTH CAROLINA.

Aiken County.—Dr. Roland Steiner, of Grovetown, Georgia, reports, April 27, 1895, that "I send a cache of rhyolite or schist arrowpoints, 65 in number, triangular and rudely stemmed, found in North Augusta on the South Carolina side of the Savannah River, opposite Augusta, Georgia." These were received in due course by the U. S. National Museum, and are catalogued as No. 170768.

GEORGIA.

Col. Charles C. Jones, jr., makes a somewhat elaborate description of the primitive manufactures of spear and arrow heads. He quotes at length from Catlin the methods observed by him and reported in his "Last Rambles amongst the Indians."[2]

The McGlashan collection (Cat. Nos. 131966-132250, U.S.N.M.) contains 20,000 specimens of arrowpoints or spearheads, all gathered by a single person from a single locality, and largely of one material. They belong to Division III, stemmed, sometimes shouldered and barbed. These were not reported as en cache, but it is probable many of them were.

FLORIDA.

Brevard County.—Cache of 12 or 13 pendant ornaments, or "plummets, pendants, or charms," in a mound near Melbourne, called Turkey Creek mound, reported by Mr. Clarence B. Moore in "Certain aboriginal mounds of the coast of South Carolina."[3]

Hernando County.—Cache of 24 implements, stemmed, shouldered, but not barbed (Division III, Class B), of white flint (chalcedony), found 2 feet below the surface at Brooksville, Hernando County, Florida, by J. J. Bell. (Cat. No. 170497, U.S.N.M.,

Volusia County.—Cache of ceremonial implements (banner stones?), found in a mound near Tomoka Creek.[4]

ALABAMA.

Blount County.—Cache of 17 chipped implements.[5]

KENTUCKY.

Boyd County.—Cache of 165 leaf-shaped (Division I, Class A) gray flint implements from Ashland. Average size $3\frac{3}{4}$ by $1\frac{5}{8}$ inches by $\frac{3}{8}$ of an inch. (E. J.Taylor, Cat. No. 150177, U.S.N.M.)

Todd County, Dycus farm, 3 miles east of Trenton.—Cache, number not given.[6]

Uniontown, Union County.—Cache of 140 hornstone knives. Two caches, number not given,[7] 6 miles above Caseyville.

[1] What rite or ceremony does this indicate, or what kind of Indian medicine does it represent? T. W.

[2] Smithsonian Report, 1879, p. 381.

[3] Philadelphia, 1898, pp. 189-191.

[4] A. E. Douglas, Proceedings American Association for the Advancement of Science, XXI, 1872.

[5] Frank Burns, Smithsonian Report, 1882, p. 826.

[6] James D. Middleton in Cyrus Thomas's Catalogue, p. 99.

[7] Gerard Fowke, Thomas's Catalogue.

TENNESSEE.

Carter County.—John W. Emmert, of Bristol, Tennessee, reported May 4, 1892, a cache of leaf-shaped implements of quartzite from the bank of the Watauga River, Carter County, northwestern Tennessee, consisted of 18 pieces 6½ to 9 inches in length, 3 to 3½ inches in width, and ⅝ to ⅞ of an inch in thickness. They were buried 2 feet below the surface, laid on the flat side, and arranged in a circle with the points to the center, the cache being about 2 feet in diameter. The hole in which they were deposited was dug through the soil and into the hard yellow clay. Nothing was found associated with them, although there was an aboriginal cemetery in the neighborhood. (Deposited by T. W., Cat. No. 150195, U. S. N. M.)

ARKANSAS.

Plate 61 represents 5 specimens out of a cache of 14, found on the banks of the Little Missouri River, Arkansas. They were deposited together, the edges overlapping, in a layer of hard yellow clay, on the terrace hillside back from the river bank, and were unassociated with other objects. They are of milk-white chalcedony, and are from 11 inches in length down. They are classified as Division III, Class C, stemmed, shouldered, and barbed. (Deposited by T. W., Cat. No. 150196, U. S. N. M.)

MISSOURI.

Near St. Louis.—"There are also a few cache finds, notably those large spades from 12 to 18 inches in length. We have a number of other cache finds, not so large in size, but equally fine in workmanship. * * * The spades and hoes come from near St. Louis, and are usually found in the vicinity of mounds. They comprise all the known forms, and many are polished on one end, which is probably caused by digging in the earth." (The Missouri Historical Society exhibit of St. Louis at the World's Columbian Exposition, Chicago, Illinois, under the direction of William J. Seever.)

Chariton County.—"Mr. John P. Jones, of Keytesville, Chariton County, Missouri, communicated to me some particulars of three deposits of flint implements brought to light in the neighborhood of his home. The first was a store of spearheads and arrowpoints, several hundreds in number, which he was too late to secure or satisfactorily examine. The weapons were all new, a fact conclusive that here had been the arsenal of a tribe or the secreted stock in trade of another primitive American merchant."

Better fortune attended Mr. Jones in the discovery of a second deposit, consisting of 17 new flint knives, as the greater number of them fell into his possession.

A third deposit described by Mr. Jones was discovered in the valley or "second bottom" of Chariton River, and contained about 50 small, flat, ovoid, pointed flints. "They had been stuck into the ground, point down, in concentric circles, and were then covered with earth, forming over them a low, flat mound 12 or 18 inches in height by 5 or 6 feet in diameter. * * * Some were gapped on the edges, and all were to a certain extent polished."[1]

OHIO.

Ross County.—Messrs. Squier and Davis,[2] during their survey of the earthworks of Ohio, opened a broad but low mound of "Clark's Works," in Ross County, of that State. They made an excavation 6 feet long and 4 feet wide, from which they took about 600 specimens of flint disks, en cache, placed in two layers edgewise. The deposit extended beyond the limits of their excavation on every side, and hence the actual number of specimens was not ascertained by them. The implements are described as ovoid or roundish, or terminating in a blunt point at one

[1] J. P. Jones, J. F. Snyder, Smithsonian Report, 1876, p. 435.

[2] Ancient Monuments of the Mississippi Valley, pp. 158–214, pl. x.

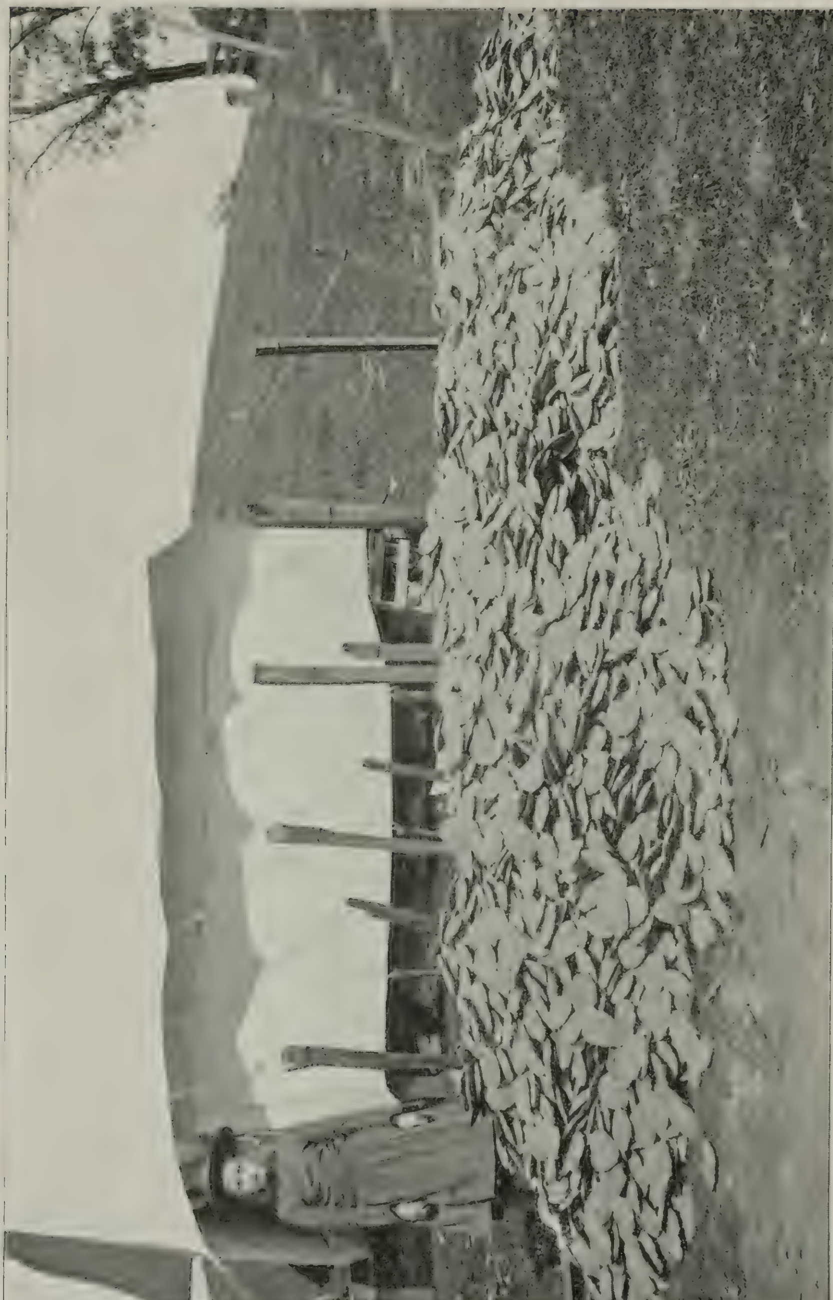
LARGE SPEARHEADS OF CHALCEDONY.

Little Missouri River, Arkansas.

FLINT DISKS MADE FROM CONCRETIONARY FLINT NODULES.

(Upper specimen) Illinois; (lower) Ohio.

Cat. Nos. 139924, 27587, U.S.N.M.



PILE OF 7,382 CHIPPED FLINT DISKS, CACHED IN MOUND 2, HOPEWELL FARM.

Anderson Station, Ross County, Ohio.

Prof. Warren K. Morehead, 1891.

LARGE SPEARHEADS OF CHALCEDONY.
College Corners, Ohio.

end. They were of various sizes, but on an average 6 inches long, 4 inches wide, and an inch thick in the center (Plate 62, fig. 1). Some were rudely blocked out; in others the circumference was chipped to a more or less defined edge. The material is flint or hornstone of fine texture, generally of a gray color, and showing sometimes concentric bands, in the center of which is a nucleus of blue chalcedony, thus demonstrating that the flint was formed in nodules and not in strata or layers.

In October, 1891, Prof. Warren K. Moorehead, while working for the Department (M) of Ethnology, World's Columbian Exposition, Chicago, continued the suspended excavations of Squier and Davis, and opened what he has described as Mound No. 2, on Hopewell farm, Anderson Township, Ross County, near Chillicothe. In three days' work Professor Moorehead took out 7382 of these flint disks. Others found in the immediate neighborhood increased this number to 8185.[1] Plate 63 is from a photograph of the tent, and in front of it are the flint disks as they were piled after being taken from the mound.

Summit County.—A cache of 197 leaf-shaped implements was found under the stump of a tamarack tree 3 miles west of Akron. Mr. Thomas Rhodes sent 5 of them to the U. S. National Museum, December, 1878 (Cat. Nos. 34584-31588, U.S.N.M.). They were from 5 to 7 inches long, 2¼ to 3 inches wide, and ¼ to ⅜ inch thick. Cat. No. 34584, No. 2, Plate 29, Class B, with rounded base, represents one of these specimens. Their fine chipping and exceeding thinness are to be remarked.

Buchtel College, Akron, exhibited at the Cincinnati Exposition of 1887 a cache of leaf-shaped implements similar in appearance to those found by Mr. Rhodes, whether part of the same is not known.

Scioto County.—Mr. Thomas Kinney, of Portsmouth, had 125 leaf-shaped implements belonging to a cache discovered in his neighborhood, which he exhibited at the Philadelphia Centennial Exposition.[2]

Lake County.—Colonel Whittlesey reported a cache of leaf-shaped implements found by Mr. J. C. Huntingdon near Painesville.[3]

Ashland County, Sullivan Township.—In 1872 Mr. S. W. Briggs discovered, while plowing, a cache of 201 implements about 18 inches beneath the surface. They were leaf-shaped, about 4 inches long, 2 to 2¾ inches wide and ⅜ inch thick. They were deposited in a keg-like vessel of the bark of the red elm, 10 or 12 inches in diameter and 13 inches in height. No signs of use.[4] Figs. 105 and 106 are specimens from this cache. As will be seen, both are thin, finely chipped, with rounded base and of the form of Class B.

Clarke County.—Cache of flint implements, number not given.[5]

Holmes County, Washington Township.—On the farm of Mr. Daniel Kick, 96 leaf-shaped implements of Class B. They were found in the alluvial deposit at the bottom of a pond, 3 feet beneath the surface. The U. S. National Museum possesses 2 of these specimens (Cat. Nos. 28345–46, U.S.N.M.) sent by Mr. H. B. Case. The average sizes were 2¾ to 5½ inches long, 1¾ to 2½ inches wide, and ¼ to ⅜ inch thick, very thin and finely chipped and of chalcedonic flint of the color of dirty beeswax.[6]

Butler County.—Prof. J. S. McFetridge, of College Corner, reports August 7, 1895, a cache of 7 beautiful white flint arrowpoints, more chalcedony than flint. They were all stemmed and shouldered, but not barbed (Division III, Class B), about 3¾ inches long and 1⅝ inches wide (Plate 64).

Putnam County.—Mr. Harry B. Maple, Columbus Grove, Ohio, under date of February 28, 1893, reports:

"Early this fall a farmer living about 2 miles west of town related that about seven years ago, he plowed into a nest of flints. I and a friend of mine went there

[1] Primitive Man in Ohio, p. 189.

[2] M. C. Read, American Antiquarian, I, 1879, p. 98.

[3] Idem.

[4] George W. Hill, Smithsonian Report, 1874, p. 364.

[5] Cyrus Thomas's Catalogue, p. 167.

[6] H. B. Case, Smithsonian Report, 1877, p. 267.

and dug them out. They were mostly in the clay about 2 feet deep. They nearly all consisted of a reddish material, although some were a light gray. I sent by mail to-day some samples of them."

These were duly received by the U. S. National Museum and are catalogued as No. 149611. The material appears as though from Flint Ridge. They were leaf-shaped (Division I, Class B).

Franklin County.—Cache on Wetmore farm, northwest one-half of section 2, township 1, range 18. Number not given.[1]

Montgomery County.—Two miles west of Centerville, on farm of Mr. W. Whitman. Cache of 640 leaf-shaped implements, Class B, rounded base. They were placed edge up and thus about two dozen were broken by the plow. The weight of the cache was 49 pounds.[2]

Columbiana County.—Mr. I. L. Kite, in a letter of February 25, 1878, published in the Cleveland Herald, describes a find near Damascus. "The deposit would fill a bushel basket. They were all placed on the broad end, enough set up to fill a certain circle, then another on top, and then another until a perfect cone was formed."

INDIANA.

Thirty miles south of Chicago.—Cache of 96 leaf-shaped implements pointed at both ends (Division I, Class A), from 8½ to 4 inches long, of dark grayish-brown jaspery flint, buried under a stump. Discovered and reported August 2, 1895, by Dr. Daniel B. Freeman, 4080 Drexel Boulevard, Chicago, Illinois.

Cache of 82 specimens found near Blue River by Mr. Ira Williams of Borden, Indiana. These are similar to the flints found by Dr. Snyder in Illinois and Professor Moorehead in Ohio, slightly pointed at both ends, made from similar nodules of black flint. The largest is about 6 inches long and 5 inches wide, while the smallest is about 3 inches long and 2 inches wide.

Franklin County.—Small caches of flint disks have been found, one cache containing 12, another 80 or 90 disks.[3]

ILLINOIS.

White and Jefferson counties.—"In the Smithsonian Report for 1876[4] is cited a remark of Messrs. Squier and Davis relating to the disks of black flint. There have been two deposits found in this country, one in the county south of us (White), and one in the county west (Jefferson). The first one contained 13 of them, of which I obtained 8, and the other contained 46, of which I obtained several."[5]

Jackson County.—A cache of 100 implements made from chert nodules found in calcareous rocks near Carbondale, Jackson County, Illinois. Size from 7 by 5½ inches to 4 by 3½ inches. Donated by Mr. John G. Sims; collected by Mr. J. D. Middleton. Cat. No. 88451, U.S.N.M.

Union County.—Eight hornstone disks, large, from Union County, Illinois. T. M. Perrine, Cat. Nos. 27853–27860, U.S.N.M. (Plate 62, fig. 2).

Schuyler County.—A few years ago, at Bluff City, Illinois, some hogs confined in a pen at the foot of the bluffs rooted out of the ground a deposit of 16 polished-stone axes, all of which bore marks of use. They were of hard, compact diorite, and varied in size from 6 to 16 inches in length, and from 2 to 7 inches in width. Considering the probable uses to which these tools had been applied, and the location of the deposit, in a spur of the bluff near the (Illinois) river, it was plain that here, in ages past, a canoe had been constructed. The work completed, the tools were cached at the foot of the bluff, until they should again be needed for similar work.[6]

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[1] Thomas's Catalogue, p. 171.

[2] S. H. Binkley, American Antiquarian, III, 1881, p. 144.

[3] Edgar R. Quick, Smithsonian Report, 1879, p. 373.

[4] Page 436.

[5] H. F. Sibley, Smithsonian Report, 1881, p. 589.

[6] J. F. Snyder, Smithsonian Report, 1876, p. 434.

In the year 1860 a similar deposit of hornstone was discovered in this vicinity, in the town of Frederickville, Schuyler County, on the west side of the Illinois River. This locality was a favorite abiding place of the Indians and the center of a dense population. Relics of their work are still found in abundance throughout this region. A small ravine near the foot of a bluff, one day after a heavy rain, caved in on one side, and the displacement of a large quantity of earth in consequence exposed to view a few strange-looking flints. They had been buried about 5 feet below the surface of the hillside, laid together on edge, side by side in long rows, forming a single layer of unknown extent. The discovery of such novel objects attracted some of the villagers to the place, who dug out about 3,500 of the unique implements, and, their curiosity satisfied, abandoned the work without reaching the limits of the deposit. * * * The stone of which these disks are made is a dark, glossy hornstone, undistinguishable from the disks of the sacrificial mound in Ohio.[1]

Carroll County.—In the town of York, on section 7, is a deposit of flint chippings. On the top of a high sand ridge, for a space of a mile long and half a mile wide, flint chippings are exposed. In some places they occur in masses of a peck or half a bushel; in other places they whiten the ground for yards. The material is a cream-colored chert, breaking with a smooth conchoidal fracture. It was all brought there, as no stone is found in situ in the whole ridge. Here was a great manufactory of arrowpoints and other flint implements. Pieces of arrowpoints and fragments of the flint in all stages of manufacture strew the ground. Perfect arrowpoints are sometimes found in clusters. Twenty-six were recently picked up in one nest—rough, but well-nigh finished.[2]

Cass County.—"In the spring of 1880, Mr. George W. Davis, farmer in Monroe precinct, Cass County, Illinois, 10 miles east of the Illinois River, while plowing, observed a few sharp-pointed flints, and found that they formed part of a deposit of 32 small implements which had been carefully placed in the ground on edge, side by side, with their points toward the north. They seem to have been buried. With one exception they are of a cherty, muddy-looking siliceous stone, of a grayish color streaked with white; a flinty formation occurring in all lead-bearing strata of Illinois, and identical with the cherty nodules and seams in the subcarboniferous outcrops of the upper Mississippi and southwestern Missouri. They had been buried new, showing no marks of use, and their peculiar style of workmanship and similarity of design leave little doubt that they are the product of the same artisan. The exceptional one in the deposit is a well-proportioned and perfect spearhead nearly 3 inches in length, neatly chipped, of opaque milk-white flint, strongly contrasting in material, shape, and finish with the others, and evidently manufactured by some other hand, perhaps in a different and remote workshop. Fourteen of the lot are laurel-leaf or lanceolate pattern, pointed at one end and rounded at the other, with edges equally curved from base to point, averaging three-eighths of an inch in thickness in the middle and evenly chipped to a cutting edge all around. They are uniform in shape, but differ in size; the smallest measuring 2¾ inches in length by 1¼ inches in width at the center; and the largest one 6 inches long and nearly 2 inches wide. They are of a type common in all parts of the Mississippi Valley, and are supposed to have been used as knives or ordinary cutting tools. The remaining 18 are shaped alike, differ in size, but are of the same average thickness. They, too, are sharp-pointed at one end, but in outline from base to point their sides are unequally convex, one being slightly curved and the other curved but little from a straight line, giving them an ungainly and lopsided form. Their broad ends, originally rounded, probably like the first 14, have been chipped away on each side for a half or three-fourths of an inch from the extremity, forming a broad, rudimentary shank. (See Chap. IX, p. 946.)

[1] J. F. Snyder, Smithsonian Report, 1876, p. 437.

[2] James Shaw, Smithsonian Report, 1877, pp. 256, 257.

A deposit of flints was turned up by the plow, on March 28, 1882, on the southern border of Cass County, 26 miles east of the Illinois River. Its location was on the brow of the hills overlooking Indian Creek to the south. In this cache were 35 elegant flint implements entirely different in form, material, and finish, from those before described. Their position in the ground was vertical and closely packed together, but otherwise without any peculiar arrangement. The 35 beautiful flints of this Indian Creek deposit are the perfection of ancient stone-chipping art. In form they are of the broad or lilac-leaf pattern, pointed more or less obtusely at one end and regularly semicircular at the other; the length but little exceeding the width; scarcely more than three-eighths of an inch thick, they are smoothly chipped to an even, sharp edge all around. They vary a little in size and somewhat in proportions; the smallest of them is 3¼ inches long by 2⅝ inches broad at the base, and the largest one measures 5 inches in length and 3¼ inches across the widest part. Six of them are made of mottled red and brown glossy jasper, and the remaining 29 of ordinary white flint shading in texture from the compact translucent glassy to the opaque milk-white varieties. The rounded edge of each is smooth and worn, and the sides of some are gapped, testifying to long and hard usage before their interment, and indicating conclusively that the broad circular edge of the tool was the one chiefly used.[1]

In the summer of 1872 I received intelligence that a deposit of the same sort of flints had been found at Beardstown (Cass County). In excavating a cellar for a new building on Main street, the laborers had reached the depth of 4 feet when they struck the flints, and soon threw them all out (about a thousand in number), a large portion of which I secured. The disposition of the flints in this deposit was different from that in the Ohio mound, and that of the Frederickville deposit also. These were embedded in the bank of the river, above the reach of highest water, and about 300 yards up the bank of the stream from the large mound. An excavation about 5 feet deep had been made through the sand to the drift clay, and, instead of being placed on edge, as in the two other deposits, a layer of the disks had been placed flat on the clay, with points upstream, and overlapping each other as shingles are arranged on a roof. Over the first layer of flints was a stratum of clay 2 inches in thickness; then another layer of flints was arranged as the first, over which was spread another 2-inch stratum of clay, and so on, until the deposit comprised five series or layers of flints, when the whole was covered with sand. The area occupied by these buried flints measured in length about 6 feet, and in width 4 feet. * * * No traces of fire were visible, nor had there been within the recollection of the oldest settler of the place any mound or other external object to mark the place of deposit. The flints of this lot are identical in material, color, style of execution, and general outline and dimensions with those I have seen from deposits at Frederickville and Clark's Works in Ohio. A few of them are almost circular in shape. Some are rough, but the majority are very accurately proportioned and neatly finished, which we may accept as proof that the implements were manufactured by several artisans who possessed unequal degrees of skill. Their average length is 6 inches, their width 4 inches, and they are three-fourths of an inch thick in the middle. Their average weight is 1½ pounds. * * * They were all made from globular or oval nodules of black or dark-gray hornstone, which were first split open and each part again split or worked down by chipping to the shape and size required. In several of the specimens the first fracture of the nodule forms the side of the implement, with but slight modification beyond a little trimming of the edges. Many of them retain in the center the nucleus around which the siliceous atoms agglomerated to form the nodule. In a few the nucleus is a rough piece of limestone; in others it consists of fragments of beautifully crystallized chalcedony, surrounded by regular light and dark circles of eccentric accretion

[1] J. F. Snyder, Smithsonian Report, 1881, pp. 564-568.

[see Plate 62], and the exterior of the rock was incrusted with a compact, drab-colored calcareo-siliceous coating of half an inch in thickness, which in some of the specimens has not been entirely removed. Nearly all the Beardstown disks were roughened and discolored with patches of calcareous concretion almost as hard and solid as the flint itself, indicative of undisturbed repose in their clay envelopes for a great period of time."[1]

Lake County.—Cache of 12 specimens.[2]

Schuyler County.—Two barrels of specimens.[3]

Peoria County, Millbrook Township.—Cache, number unknown.[4]

St. Clair County.—"The finest Indian mound in the State of Illinois is situated 3 miles northeast of the town of Lebanon, in St. Clair County, not far from the western border of Looking-glass Prairie. In shape it is a truncated pyramid, or rather a parallelogram, measuring at its base 400 feet in length and 250 feet in width, and rising in perfect proportions to the height of 50 feet. The angles are still sharp and well defined and the top level, comprising (approximately) an area of 80 by 150 feet, which doubtless served as the base of some elaborate wooden structure. In the summer of 1843 the proprietor of the land, Mr. Baldwin, in sinking a well near one corner of the mound, found, a few feet below the surface, packed closely together, 18 large flint spades. These implements were broad, flat pieces of white or grayish white flint, measuring, the smallest 9 inches in length by 5 inches in width, the largest 15 by 7 inches. They are nearly an inch in thickness in the middle, neatly chipped to an edge all around, flat on one side and slightly convex on the other. One end of each flint is broader than the other, and the broad end is symmetrically rounded, and polished as smooth as glass by long-continued use in sandy soil. The narrow end is rough and not so neatly finished, showing no marks of wear, and was, in all probability, when the implement was in use, fastened in some sort of handle. It can not be doubted that these flints were in part the tools used in making the mound, and when the great work was finished they were stored away in the ground until again needed.[5]"

"In the early part of December, 1868, some laborers, while engaged in grading an extension of Sixth street, in East St. Louis, came upon a deposit of Indian relics, * * * flint tools, all of the hoe and shovel type, and * * * close by were found several bowlders of flint and greenstone, weighing from 15 to 30 pounds each, and many fragments of flint. The deposit was covered with from 18 to 24 inches of black earth. * * * The implements formed a "nest" by themselves, and instead of being packed close together were arranged with some regularity, overlapping each other or standing edgewise and covering a circular space. The whole deposit did not extend more than 7 or 8 feet on either side. The contractor neglected to count the implements, but he thinks there were from 70 to 75 in all—some 50 hoes and about 20 shovels. No other stone articles, such as arrow and spear heads, tomahawks, etc., had been deposited with the agricultural implements.[6]"

"In the summer of 1869 some children amusing themselves near the barn on the farm of Mr. Oliver H. Mullen, in the neighborhood of Fayetteville, St. Clair County, dug into the ground and discovered a deposit of 52 disk-shaped flint implements, which lay closely heaped together.[7]"

[1] J. F. Snyder, Smithsonian Report, 1876, pp. 438, 439.
[2] Foster's Prehistoric Races of the United States of America, p. 209
[3] George Trauman, Smithsonian Report, 1879, p. 435.
[4] Cyrus Thomas's Catalogue, p. 63.
[5] J. F. Snyder, Smithsonian Report, 1876, p. 434.
[6] Charles Rau, Smithsonian Report, 1868, pp. 402, 403.
[7] Idem., 1872, p. 402.

MICHIGAN.

Saginaw Valley.—Nine caches of arrow and spearheads were reported by Mr. Harlan I. Smith, of Saginaw East Side, before Section H of the American Association.[1] They were all chipped blades of chert, believed to have been made from nodules of the Subcarboniferous period, which outcrops in a circular line in Saginaw Bay near Bayport. They are as follows:

No. 3. Frazier cache No. 1, 300 pieces. (1) Large black leaf-shaped implements 8 inches long with delicate stem at tip of base (turkey tail); (2) similar implements about 3 inches long; (3) small, yellow chert, leaf-shaped; (4) a few of the same, notched. Six miles from Saginaw, on the Tittabawassee River.

No. 4. Frazier cache No. 2, one large black leaf-shaped implement similar to those in cache No. 1, surrounded by 13 rubbed stones. A few feet from Frazier cache No. 1, about 1 foot deep.

No. 5. Merrill cache, 100 pieces, 1 foot depth.

No. 6. Cass cache No. 1, 70 pieces; leaf-shaped, 2 inches long, of dark-blue color, and different from the chert found in the other caches. Eight inches in depth, south bank of Cass River and 3 miles above Bridgeport.

Cass cache No. 2, 22 pieces and 12 nodules, with abundance of chips and flakes. South side of Cass River, 4 miles below Saginaw.

No. 8. Willie cache; 175 chipped blades, triangular, 1½ inches long. North bank of Cass River, 3 miles above Saginaw.

No. 9. Bayport cache; 47 pieces, rude leaf-shaped, laid in a roll overlapping each other, reminding one of shingles on a roof. Two feet depth.

By letter of August 10, 1894, Mr. Smith reports the extension of his discoveries to include 14 caches.

South Saginaw.—Mr. E. S. Golson, in letters of February 16 and May 9, 1892, describes two caches he found at or near his home at Green Point. One was found April 26, 1890, and consisted of 83 rude and thick leaf-shaped implements of "Bayport" stone on the "west bank of the Tittabawassee River at its mouth, about one-half mile from the mounds at Green Point." They were buried about 4½ feet under the surface and were placed together in a hole a foot or more in depth and width. These were sent by him to Peabody Museum. He found his second cache on the day he wrote his last letter. The specimens, 58 in number, were smaller than those in the former. They were of three sizes; all were leaf-shaped except one stemmed. None were deeper than 18 inches, and they had probably been disturbed by the plow, as they were not arranged with any system, but were scattered over a space of 6 feet square. They were all of the same size.

WISCONSIN.

Racine County.—"Some workmen, in digging a ditch through a peat swamp near Racine, found a deposit of disks of hornstone, about 30 in number. They lay on the clay at the bottom of the peat about 2½ feet below the surface. Some of the disks were quite regular; they vary from half a pound to a pound in weight."[2]

Dane County.—Cache of 300 leaf-shaped (Division I, Class A) implements of porphyritic felsite, found in Madison, Dane County, Wisconsin, by Mr. A. R. Crittenden. (Cat. No. 34255, U.S.N.M.)

Kewanee district trail.—Cache of 42 copper implements. Twenty-five of these were found at one time and described by the person who discovered them (a squaw) as a large green stone which she kicked and it fell apart, and upon picking it up she found about 25 different specimens. In going over the ground at the same spot

[1] Proceedings, XLII, 1893, p. 300. Madison, Wisconsin.

[2] Dr. Hoy, I. A. Lapham, Antiquities of Wisconsin, p. 8.

a year or two later 17 more implements were found, and near at hand were a group of polished-stone hatchets, one very large maul with center grooved, and a half dozen flint arrowpoints, the whole having been looked upon since as a cache, and are considered by the present owner, Mr. Wyman, as a kit of ancient mining tools left on the trail from the Kewanee district. Silver is plainly discernible in many of the objects of the native copper.

Calumet County—A cache of 22 leaf-shaped flint implements averaging from 2 to 2½ inches in width and 4 inches in length and standing on edge was found under a stump in Calumet County. A cache of 5 leaf-shaped implements was found near Kachena. Another cache of 7 arrowpoints from near New Holstein. Nearly all of the arrowpoints and spearheads are of quartzite, varying from the light-colored material to that of a dark maple-sugar color, and in size from 1½ to 9½ inches. Mr. Hayssen has found a ledge of this quartzite near Black River Falls, where a large workshop is plainly indicated. (Hayssen Collection, NewHolstein, Wisconsin.)

MINNESOTA.

Mower County—Mr. Thomas B. Smith, of Rose Creek, October 8, 1895, reports that he has found in a cache on his farm 48 arrowpoints.

OREGON.

Rev. M. Eells, a veteran archæologist of Oregon,[1] speaking of stone spearheads and arrowpoints in that country, says "they were scarce, never having been made in modern times, but belonging only to ancient times. At Oregon City, about half a mile below the falls, is a perfect mine of them which had been unearthed by high water. A workshop was at the Umatilla landing, where Mrs. Kunzie has obtained many, some as beautiful as can be made. The chips are now seen all around, though the stone of which they were made—much the same as that used at Oregon City—must have been brought long distances."

[1] Stone Age of Oregon, Smithsonian Report, 1886, p. 289.

APPENDIX C.[1]

LARGE IMPLEMENTS OF ARROWPOINT OR SPEARHEAD FORM.

There are certain implements found throughout the United States, more especially the western and southwestern, which, except for their immense size, are identical in form with certain spear and arrow heads. An implement 2 or 3 inches in length will be recognized as an arrowpoint; if 5 or 6 inches in length it might be a javelin, lance, or spear; but when we encounter one, however correct it may be as to form, or fine as to workmanship, which is 10 inches or a foot in length, then what shall we call it and how shall we define its use? The U. S. National Museum possesses many of these specimens. Some of them have been found in cache, some in mounds and burial places, others sporadically, on the surface. Their great size and weight, while it does not absolutely interdict their attachment to a shaft or handle, nor their use as a weapon, render both extremely unlikely, or they might have been used ceremonially. But we are absolutely without other knowledge as to their use or purposes than that furnished by the implements themselves and their associations.

George F. Arvedson, of Carpentersville, Illinois, reported the finding of an implement of white flint or chalcedony of the form of a spearhead, stemmed and shouldered, not barbed (Division III, Class B) 15 inches long, $2\frac{3}{4}$ inches wide and $\frac{5}{8}$ inch thick.

C. D. Williams, of Gainesville, Florida, reports having found in southwestern Georgia an implement of spearhead form (Division III, Class C) stemmed, shouldered, and barbed, of gray flint, $14\frac{1}{4}$ by $4\frac{1}{2}$ inches by 1 inch.

Messrs. M. H. Spillman and E. B. Sumner, of Painesville, Lake County, Ohio, report the discovery, while digging in a mound near that town, of an implement of white flint or chalcedony, shouldered, stemmed, and barbed (Division III, Class C) $12\frac{1}{4}$ inches long, $3\frac{1}{2}$ inches wide, and $\frac{3}{4}$ inch thick.

The following are representative large-sized spear and arrow heads in the U. S. National Museum:

One from West Derby, Vermont (Cat. No. 8922, U.S.N.M.) $11\frac{1}{2}$ by $2\frac{3}{4}$ inches by $\frac{5}{8}$ inch, of reddish iron-clay slate, leaf-shaped (Division I, Class B), reported by J. M. Currier and R. Wheeler.

Cat. No. 8923, U.S.N.M., from West Derby, Vermont, of reddish iron-clay slate, $11\frac{3}{4}$ by $1\frac{15}{16}$ inches by $\frac{3}{8}$ inch, leaf-shaped (Division I, Class B), reported by H. W. Norris and J. M. Currier.

Cat. No. 98341, U.S.N.M., from a mound at Prairie du Chien, Crawford County, Wisconsin, of chalcedony, 11 by $2\frac{1}{2}$ inches by $\frac{5}{8}$ inch, leaf-shaped (Division I, Class B). Mound excavated by J. W. Emmert, of the Bureau of Ethnology.

Cat. No. 115501, U.S.N.M., from mound in Prairie du Chien, Crawford County,

[1] See p. 872.

SPEARHEAD OF WHITE FLINT.
Length, 15 inches.
Carpentersville, Illinois.

Wisconsin; obsidian, $7\frac{3}{4}$ by $2\frac{3}{4}$ inches by $\frac{3}{4}$ inch, stemmed, shouldered, and barbed (Division III, Class C). Mound excavated by J. W. Emmert, of the Bureau of Ethnology.

Cat. No. 150196, U.S.N.M., found en cache in the valley of the Little Missouri River, southwest Arkansas; chalcedony. There were 14 implements, all of white flint or chalcedony, of spearhead form, stemmed, shouldered, and barbed (Division III, Class C). They varied in size from $9\frac{1}{2}$ by $3\frac{5}{8}$ inches by $\frac{3}{4}$ inch down to $6\frac{1}{4}$ by $2\frac{3}{8}$ inches by $\frac{1}{2}$ inch. Collection T. W. (Plate 61.) There are in the U. S. National Museum 3 other specimens similar in size, form, and material, reported from Shreveport, Louisiana, by Mr. Hotchkiss.

Cat. No. 150195, U.S.N.M., represents a cache of leaf-shaped implements from the bank of the Watauga River, Carter County, northwest Tennessee. They were leaf-shaped in form (Division I, Class B), were of quartzite, 18 in number, their size varying from $9\frac{1}{8}$ by $3\frac{9}{16}$ inches by three-fourths of an inch to $7\frac{13}{16}$ by $3\frac{3}{16}$ inches by $\frac{3}{4}$ inch. Collection T. W.

Cat. No. 88112, U.S.N.M., from Middleton, Wisconsin; fine-grained, sparkling quartzite, light-gray color, spearhead form, stemmed, shouldered, and barbed (Division III, Class C), $8\frac{1}{2}$ by $3\frac{1}{8}$ inches by $\frac{1}{2}$ inch. Collection of Bureau of Ethnology. See also figs. 170, 171, 172, pp. 924–926.

Cat. No. 88335, U.S.N.M., from Middleton, Wisconsin, of fine-grained quartzite, dark color, nearly black, spearhead form, stemmed, shouldered, and barbed (Division III, Class C), $8\frac{7}{8}$ by $2\frac{3}{4}$ inches by $\frac{1}{2}$ inch. Collection of Bureau of Ethnology.

Cat. No. 150179, U.S.N.M., from Ashland, Kentucky, of brown chert, spearhead form, stemmed and shouldered but not barbed (Division III, Class B), $8\frac{1}{2}$ by $2\frac{15}{16}$ inches by $\frac{3}{8}$ inch. Obtained from E. J. Taylor.

Cat. No. 88105, U.S.N.M., from Wisconsin, of brown lustrous pyromachic flint, spearhead form, stemmed and shouldered, not barbed (Division III, Class B), $6\frac{5}{8}$ by $2\frac{7}{16}$ inches by $\frac{3}{8}$ inch. Collection of Bureau of Ethnology.

Reference is made to the 95 implements in the cache reported by Mr. Edward Ingram from Chester County, Pennsylvania, and figured in Plate 59; also to sundry large specimens described and figured in other parts of this paper.

Dr. Abbott,[1] speaking of these large spearheads and referring to Schoolcraft, makes mention of an Indian chief presenting to him one 7 inches long and declaring it to be an implement belonging to his ancestors, and says:

> It is not a little strange that the early writers, who refer to the Indians before they had wholly discarded stone implements, or very soon afterwards, should so generally have overlooked this form, while they frequently mention their axes and arrowpoints. Neither Holm nor Kalm refer to the large spearheads as weapons of the Delaware Indians, or refer to the use of the spear or lance, in describing their methods of warfare; yet the number of these objects found is of itself sufficient to indicate that at one time they were in very common use. Is it probable that they had been discarded in great measure at some remote period and were veritable relics of a distant past when the European settlers first reached our shores? The absence of direct reference to these characteristic implements seems indicative of this.

This raises an exceedingly interesting question. Whatever may have been the purpose, and when or by whomsoever made, may they not have been themselves prehistoric to the aborigines at the time of the discovery of the continent? Are they to be classed with the so-called ceremonial objects, banner-stones, bird and boat shaped articles, and with tubes, plummets, sinkers, or charms, not only the uses or purposes

[1] Primitive Industry, p. 248.

of which are unknown to our modern Indian, but even the races or peoples by whom they were made; all of which gives rise to numberless speculations?

There are certain other large stone implements of leaf-shaped form resembling Class B, and from description and drawing might be assigned to it. These are the so-called hoes or agricultural implements. Their locality is extensive, but nevertheless, is limited to the interior, say from Ohio to Georgia, and from the Virginia mountains to the western Mississippi Valley. The implements are large, being from 6 to 16 inches in length, with corresponding width and thickness. They are of quartzite, novaculite, chert, and similar material, and are always chipped. Although resembling in form the ordinary leaf-shaped implement, they have no other or further relation to it. While they are more or less pointed at both ends, yet they are not sufficiently so for thrusting or piercing, and were evidently never intended for such purposes. They may have been inserted in a handle, though no traces of it have ever been found, or they may have been held in the hands. An inspection shows them to have been used as an implement for digging in the earth. The point is frequently worn smooth and dull for several inches up the blade, showing striæ and even notches, the result of friction in the earth by digging.

These implements are sometimes found en cache. The collection of the Missouri Historical Society displayed at the World's Fair held in Chicago, in 1893, under the direction of Mr. William J. Seever, contained many of these implements, chiefly from the neighborhood of St. Louis, some of which were from caches. See Appendix A (quarries), Illinois, p. 966, and Appendix B (caches), p. 974.

APPENDIX D.[1]

MAKING OF ARROWPOINTS DESCRIBED BY EXPLORERS AND TRAVELERS.

Catlin[2] thus describes the Apache mode of making flint arrowpoints:

Like most of the tribes west of and in the Rocky Mountains they manufacture the blades of their spears and points for their arrows of flints, and also of obsidian, which is scattered over those volcanic regions west of the mountains; and, like other tribes, they guard as a profound secret the mode by which the flints and obsidian are broken into the shapes they require. * * *

Every tribe has its factory in which these arrowheads are made, and in those only certain adepts are able or allowed to make them for the use of the tribe. Erratic bowlders of flint are collected (and sometimes brought an immense distance) and broken with a sort of sledge hammer made of a rounded pebble of hornstone set in a twisted withe, holding the stone and forming a handle. * * * The master workman, seated on the ground, lays one of these flakes on the palm of his left hand, holding it firmly down with two or more fingers of the same hand, and with his right hand, between the thumb and two forefingers, places his chisel (or punch) on the point that is to be broken off; and a cooperator (a striker) sitting in front of him, with a mallet of very hard wood, strikes the chisel (or punch) on the upper end, flaking the flint off on the under side, below each projecting point that is struck. The flint is then turned and chipped in the same manner from the opposite side; and so turned and chipped until the required shape and dimensions are obtained, all fractures being made on the palm of the hand.

In selecting a flake for the arrowhead a nice judgment must be used, or the attempt will fail. A flake with two opposite parallel, or nearly parallel, planes is found, and of the thickness required for the center of the arrowpoint. The first chipping reaches near to the center of these planes, but without quite breaking it away, and each chipping is shorter and shorter, until the shape and the edge of the arrowpoint are formed.

The yielding elasticity of the palm of the hand enables the chip to come off without breaking the body of the flint, which would be the case if they were broken on a hard substance. These people have no metallic instruments to work with, and the instrument (punch) which they use I was told was a piece of bone; but on examining it I found it to be a substance much harder, made of the tooth (incisor) of the sperm whale or sea lion, which are often stranded on the coast of the Pacific. This punch is about 6 or 7 inches in length and 1 inch in diameter, with one rounded side and two plane sides, therefore presenting one acute and two obtuse angles to suit the points to be broken.

This operation is very curious, both the holder and the striker singing, and the strokes of the mallet given exactly in time with the music, and with a sharp and rebounding blow, in which, the Indians tell us, is the great medicine (or mystery) of the operation.

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[1] See p. 884.

[2] Last Rambles amongst the Indians, pp. 187–90.

To Catlin's description Mr. Stevens[1] makes the following approving criticism:

What Catlin has said with regard to a rebounding blow is perfectly true; it is impossible to flake flint with a dull, heavy, smashing blow; it is the measured and rebounding blow—a shock rather than a blow—which, given with judgment, enables the material to take its own line of cleavage, and produces what is so well known as the conchoidal fracture, resulting from human skill, that distinguishes the mere splinter of flint from the flint flake; and it is the repetition of this operation twenty or thirty times around the edges of those flint implements found in the drift that stamps them as proofs of human handiwork.

Admiral Sir E. Belcher[2] gives an account of the manufacture of flint arrowpoints by the western Eskimo tribes at and north of Icy Cape, as follows:

But to the process which they pursue in effecting the fine, regular, serrated edges of their flint arrowheads.

Possibly, had I not witnessed the operation and had been at the time one of the first Europeans with whom they ever had communication, the idea would have remained undisputed that they owed their formation to the stroke of the hammer. Being a working amateur mechanic myself, and having practiced in a very similar manner on glass with a penny piece in 1815, I was not at all surprised at witnessing the modus operandi. Selecting a log of wood in which a spoon-shaped cavity was cut, they placed the splinter to be worked over it, and by pressing gently along the margin vertically, first on one side and then on the other, as one would set a saw, they splintered off alternate fragments until the object thus properly outlined presented the spear or arrowhead form, with two cutting serrated edges.

But let us revert to this instrument for the use of which the untaught would never imagine a purpose, and which, I suspect, was not witnessed or deemed worthy of notice by any other individual of the expedition.

First, this instrument has a graceful outline. The handle is of fine fossil ivory. That would be too soft to deal with the flint or chert in the manner required. But they discovered that the point of the deer horn is harder and also more stubborn; therefore, in a slit, like lead in our pencils, they introduced a slip of this substance and secured it by a strong thong, put on wet, but which on drying became very rigid. Here we can not fail to trace ingenuity, ability, and a view to ornament. It is the point of the deer horn which, refusing to yield, drives off the fine conchoidal splinters from the chert. [See figs. 68–74].

I can not here omit remarking that the very same process is pursued by the Indians of Mexican origin in California with the obsidian points for their arrows; and also in the North and South Pacific—at Sandwich Islands (21° north), and Tahiti (18° south)—39 degrees or 2,340 miles asunder—similar indentations or chippings are carried out in forming their axes from basaltic lava, but probably performed in the latter instances with stone hammers. I myself witnessed at the convent of Monterey the captured Indians forming their arrowheads out of obsidian similarly to the mode practiced by the Eskimos.

Schoolcraft[3] thus describes the mode of making flint arrowpoints by the North American Indians:

The skill displayed in this art, as it is by the tribes of the entire continent, has excited admiration. The material employed is generally some form of hornstone,

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[1] Flint Chips, pp. 83, 84.

[2] Transactions of the American Ethnological Society, new ser., I, Pt. 2, 1861, p. 138.

[3] North American Indian Tribes, III, p. 467.

sometimes passing into flint. This mineral is often called chert by the English mineralogists. No specimens have, however, been observed where the substance is gunflint. This hornstone is less hard than common quartz, and can readily be broken by contact with the latter. Experience has taught the Indian that some varieties of hornstone are less easily and regularly fractured than others, and that the tendency to a conchoidal fracture is to be relied on in the softer varieties. It has also shown him that the weathered or surface fragments are harder and less manageable than those quarried from the rocks and mountains.

To break them, he seats himself on the ground, and holds the lump on one of his thighs, interposing some hard substance below it. When the blow is given, there is a sufficient yielding in the piece to be fractured not to endanger its being shivered into fragments. Many are, however, lost. After the lump has been broken transversely it requires great skill and patience to chip the edges. Such is the art required in this business, both in selecting and fracturing the stones, that it is found to be the employment of particular men, generally old men, who are laid aside from hunting, to make arrow and spear heads.

The modern manufacture of obsidian arrowpoints by the Indians of California is thus described by an eyewitness:[1]

The Indian seated himself on the floor and, laying the stone anvil upon his knee, with one blow of his agate chisel he separated the obsidian pebble into two parts; then giving a blow to the fractured side he split off a slab a quarter of an inch in thickness. Holding the piece against his anvil with the thumb and finger of his left hand, he commenced a series of continuous blows, every one of which chipped off fragments of the brittle substance. It gradually seemed to acquire shape. After finishing the base of the arrowhead (the whole being little over an inch in length) he began by striking gentle blows, every one of which I expected would break it into pieces. Yet such was his adroit application, his skill, and dexterity, that in little over an hour he produced a perfect obsidian arrowhead.

I then requested him to carve one from the remains of a broken bottle, which, after two failures, he succeeded in doing. He gave as a reason for his ill success that he did not understand the grain of the glass. No sculptor ever handled a chisel with greater precision, or more carefully measured the weight and effect of every blow, than did this ingenious Indian; for even among them arrow making is a distinct profession, in which few attain excellence. In a moment all I had read of the hardening of copper for the working of flint axes, etc., vanished before the simplest mechanical process.

Mr. T. R. Peale of the scientific corps of the United States Exploring Expedition, witnessed the making of arrowpoints among the Shasta and northern California Indians. He says that the flakes were struck off from the mass of jasper, agate, or chalcedony, by a blow with a round-faced stone, and that the edges were chipped by the application of a notch in a piece of horn, as a glazier chips glass. The notches in the horn tool were of different size and depths, in order to suit the work to be done.[2]

Every American collector, as well as archæologist, has read John Smith's description of the making of arrowpoints by the Virginia Indians.[3]

His arrowhead he quickly maketh with a little bone, which he ever weareth at his bracer, of a splint of a stone or glasse in the form of a heart, and these they glew to the end of their arrowes.

[1] Stevens, Flint Chips, pp. 77, 78. [2] Idem., p. 78. [3] Sixth Voyage, 1606.

Torquemada[1] says:

They had, and still have, workmen who make knives of a certain black stone or flint, which it is a most wonderful and admirable thing to see them make out of the stone; and the ingenuity which invented this art is much to be praised. They are made and got out of the stone (if one can explain it) in this manner: One of these Indian workmen sits down upon the ground and takes a piece of this black stone, which is like jet, and hard as flint, and is a stone which might be called precious, more beautiful and brilliant than alabaster or jasper, so much so that of it are made tablets and mirrors. The piece they take is about 8 inches long, or rather more, and as thick as one's leg or rather less, and cylindrical. They have a stick as large as the shaft of a lance, and 3 cubits, or rather more, in length, and at the end of it they fasten firmly another piece of wood 8 inches long, to give more weight to this part, then pressing their naked feet together, they hold the stones as with a pair of pincers or the vise of a carpenter's bench. They take the stick (which is cut off smooth at the end) with both hands, and set it well home against the edge of the front of the stone, which also is cut smooth in that part; and then they press it against their breast, and with the force of the pressure there flies off a knife, with its point and edge on each side, as neatly as if one were to make them of a turnip with a sharp knife, or of iron in the fire. Then they sharpen it on a stone, using a hone to give it a very fine edge; and in a very short time these workmen will make more than 20 knives in the aforesaid manner. They come out of the same shape as our barbers' lancets, except that they have a rib up the middle, and have a slight graceful curve toward the point. They will cut and shave the hair the first time they are used, at the first cut nearly as well as a steel razor, but they lose their edge at the second cut; and so to finish shaving one's beard or hair, one after another has to be used; though indeed they are cheap, and spoiling them is of no consequence. Many Spaniards, both regular and secular clergy, have been shaved with them, especially at the beginning of the colonization of these realms, when there was no such abundance as now of the necessary instruments and people who gain their livelihood by practicing this occupation. But I conclude by saying that it is an admirable thing to see them made, and no small argument for the capacity of the men who found out such an invention.

Tylor[2] says:

Hernandez gives a similar account of the process. He compares the wooden instrument used to a crossbow. It was evidently a T-shaped implement, and the workman held the crosspiece with his two hands against his breast, while the end of the straight stick rested on the stone. He furthermore gives a description of the making of the well known maquahuitl, or Aztec war club, which was armed on both sides with a row of obsidian knives, or teeth, stuck into holes with a kind of gum. With this instrument, he says, a man could be cut in half at a blow—an absurd statement which has been repeated by more modern writers.

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[1] Monarquia Indiana, Seville, 1615.

[2] Anahuac, p. 331.

INDEX.